DESIGN STANDARDS

FOR

VISUAL AIR NAVIGATION FACILITIES,

and DESIGN DRAWINGS,

Volume II

AFMAN(I) 32-1187,
TM 811-5,
MIL-HDBK 1023/6

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HQ AFCESA/CESM
Larry Strother
139 Barnes Drive
Tyndall AFB FL 32403
(850)283-6354
(850)283-6219 fax
E-mail:
larry.strother@afcesa.af.mil

USACE CENWO-ED-TX
John Gregory
215 N. 17th Street
Omaha NE 68102-4978
(402) 221-7267
(402) 221-7261 fax
E-mail:
john.b.gregory@usace.army.mil

NAVFAC Criteria Office
Vince Donnally
1510 Gilbert Street
Norfolk, VA 23511-2699
(757) 322-4204
(757) 322-4416 fax
E-mail:
DonnallyVR@efdlant.navfac.navy.mil

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INTRODUCTION

Volume II supplements AFMAN(I) 32-1187/TM 811-5, Design Standards for Visual Air Navigation Facilities, Volume I for the US Army and US Air Force, and Technical Manual NAVAIR 51-50AAA-2, General Requirements for Shorebased Airfield Marking and Lighting for the US Navy, by providing the guidance and detailed information on standard configurations and equipment. Use these manuals when designing, planning, constructing, and installing new systems.

When using these manuals, be certain that the complementary markings are installed and that no conflict occurs with the placement of light fixtures.

Specifically, this document contains figures that reference individual AutoCAD files containing the drawings, individual MS Word files containing the notes to designer for each diagram (text also provided within this document), and figure numbers for cross-referencing the drawings with this document.

The figures contained within this Volume were compiled from several sources and construction projects. The following firms and organizations contributed to the development of these figures:

- ADB Alnaco
- Amerace Ltd.
- Aviation Alliance Inc.
- Crawford, Murphy & Tilly Inc.
- Crouse-Hinds Airport Lighting Products
- Dufresne-Henry Inc.
- Federal Aviation Administration
- Flash Technology Corporation
- Jaquith Industries Inc.
- Lean Engineering Consultants, Ltd.
- Multi Electric Mfg. Inc.
- United States Air Force
- United States Army Corps of Engineers
- United States Naval Facilities Engineering Command
- Integic

Send comments and suggested improvements to:

HQ AFCESA/CESM
Larry Strother
139 Barnes Drive
Tyndall AFB FL 32403
(850)283-6354
(850)283-6219 fax
E-mail:
larry.strother@afcesa.af.mil

USACE CENWO-ED-TX
John Gregory
215 N. 17th Street
Omaha NE 68102-4978
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(402) 221-7261 fax
E-mail:
john.b.gregory@usace.army.mil

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1510 Gilbert Street
Norfolk, VA 23511-2699
(757) 322-4204
(757) 322-4416 fax
E-mail:
DonnallyVR@efdlant.navfac.navy.mil

LIST OF SUPERCEDED DOCUMENTS

The following is a list of documents that are superseded by this manual and should no longer be used for the design of airfield systems:

MIL-HDBK-1023/1	Military Handbook, Airfield Lighting, 29 Jan 1988 w/notice 1, 15 Oct 1990.

Definitive Design Drawings P-272

1404273	Portable Optical Landing Systems Plot Plan
1404291	Wheels-up & Runway Wave-off Lighting Plan, Wiring Diagrams & Details
1404292	Wheels-up & Runway Wave-off Lighting Wiring Diagram & Details
1404356	Wheels-up & Runway Wave-off Lighting Equipment Vault Plans & Details
1404676	Runway Edge Lighting System Plan, Details, and Wiring Diagram
1404677	Runway Edge Lighting Light Fixture and Handhole Installation Details
1404678	Runway Edge Lighting Duct System Plan and Details
1404679	Circling Guidance Lighting System Plan, Details and Wiring Diagrams
1404680	Runway Centerline Lighting System Plan, Wiring Diagram, Schedule & Notes
1404681	Runway Centerline Lighting Installation Details
1404682	Touchdown Zone Lighting Wiring Diagram, Schedule and Details
1404683	Touchdown Zone Lighting Fixture Installation Details
1404684	Runway End Indicator Lights Plan, Schedule and Details
1404685	Runway Threshold & End Lights Site Plan – Details & Notes
1404686	Threshold Lighting Threshold Bar Plan, Details, and Notes
1404688	Simulated Carrier Deck Lighting Plan, Circuit Wiring, and Details
1404689	Simulated Carrier Deck Lighting Wiring Diagrams and Details
1404690	Simulated Carrier Deck Lighting Details
1404692	Precision Approach Path Indicator, Details and Wiring Diagrams
1404789	Taxiway Lighting Details and Schedule
1404790	Approach Lighting System Site and Layout Plans – General Data
1404791	Approach Lighting System Vault Details and Diagrams
1404792	Approach Lighting System Circuit Diagram and Schedule
1404793	Approach Lighting System Sequence Flashing Lights
1404794	Approach Lighting System Light Bar Details
1404795	Approach Lighting System Centerline Light Bars
1404796	Approach Lighting System Details and Sections

Chapter 1: UNDERGROUND CABLE, CONDUIT AND DUCTS

1.1. Direct Buried Duct/Conduit Detail

See figure 1.

Notes to Designer:

1. Where duct/conduit is below pavement, specify type of pavement to be installed on top of trench. Where trench is cut through existing pavement, specify pavement on top of trench shall match existing.

2. Location of counterpoise is shown for two situations:

    a. Trench running parallel to pavement - see detail note #3.

    b. Trench not running parallel to pavement - see detail note #4.

Refer to Volume I for more information.

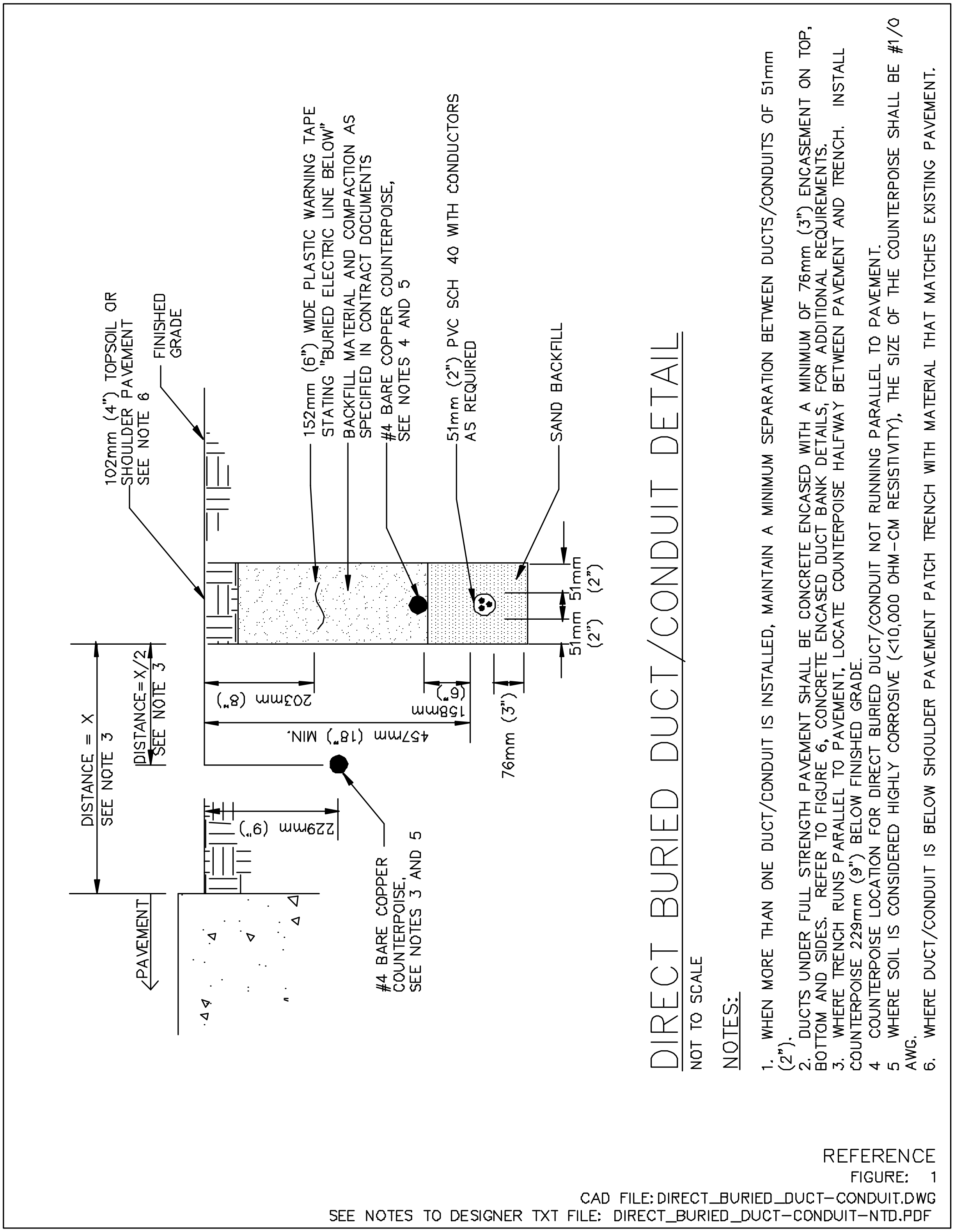


Figure 1. Direct Buried Duct/Conduit Detail

1.2. Direct Buried Cable Trench Details

See figure 2.

Notes to Designer:

1. Duct/conduit installation is the preferred method of installation. Refer to Chapter 13 in Volume I of the manual.

2. Type of trench restoration must be specified. As a minimum, the trench should be restored to match original condition (i.e., must include seed & mulch spec if turf has already been established).

3. Use #8 for 6.6 amp circuits and #6 for 20 amp circuits.

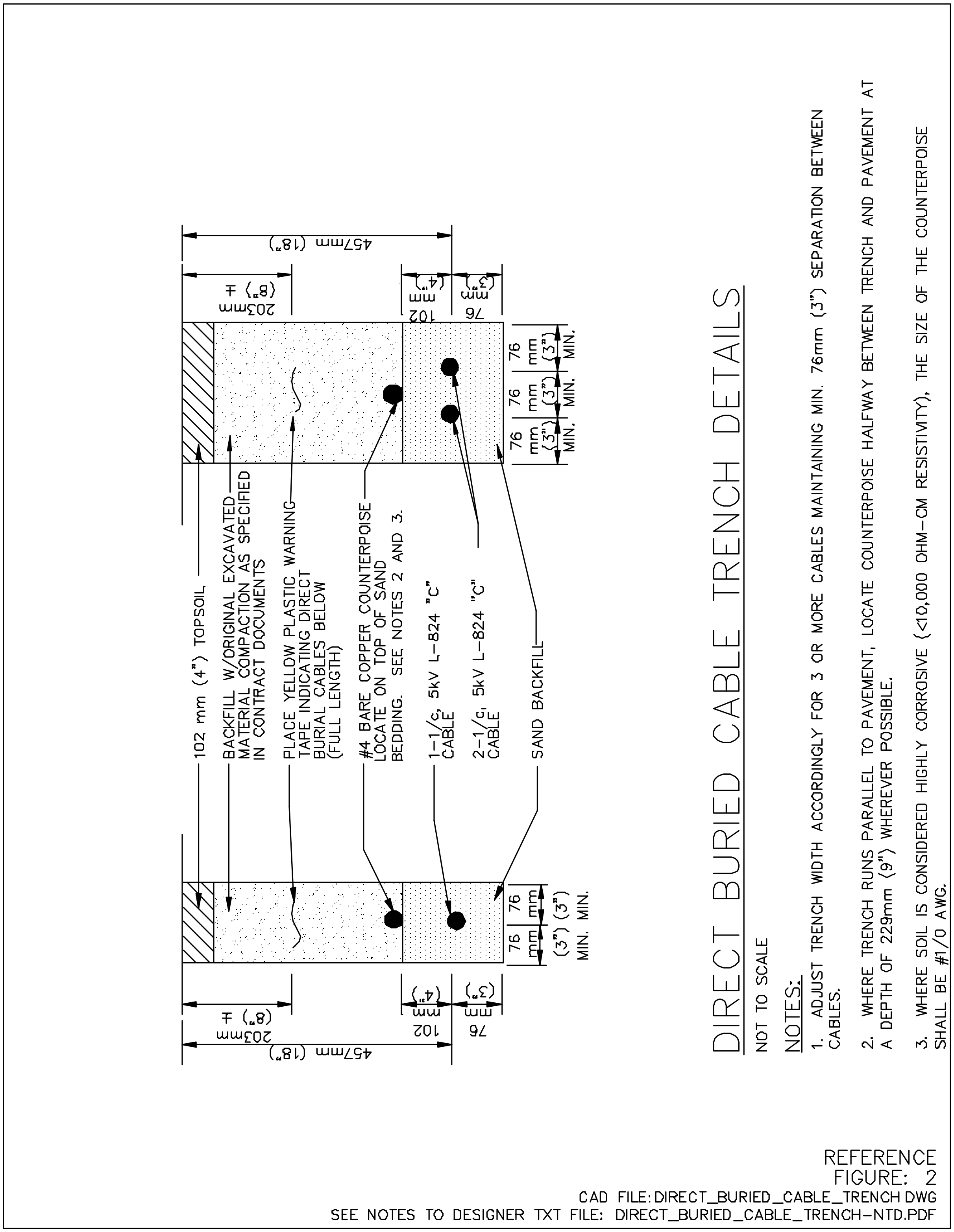


Figure 2. Direct Buried Cable Trench Details

1.3. Counterpoise & Ground Rod Installation Detail

See figure 3.

Notes to Designer:

1. This detail shows the installation of the ground rod to ground the counterpoise.

2. It is recommended the ground rod be driven on the side of the trench that is closest to the pavement.

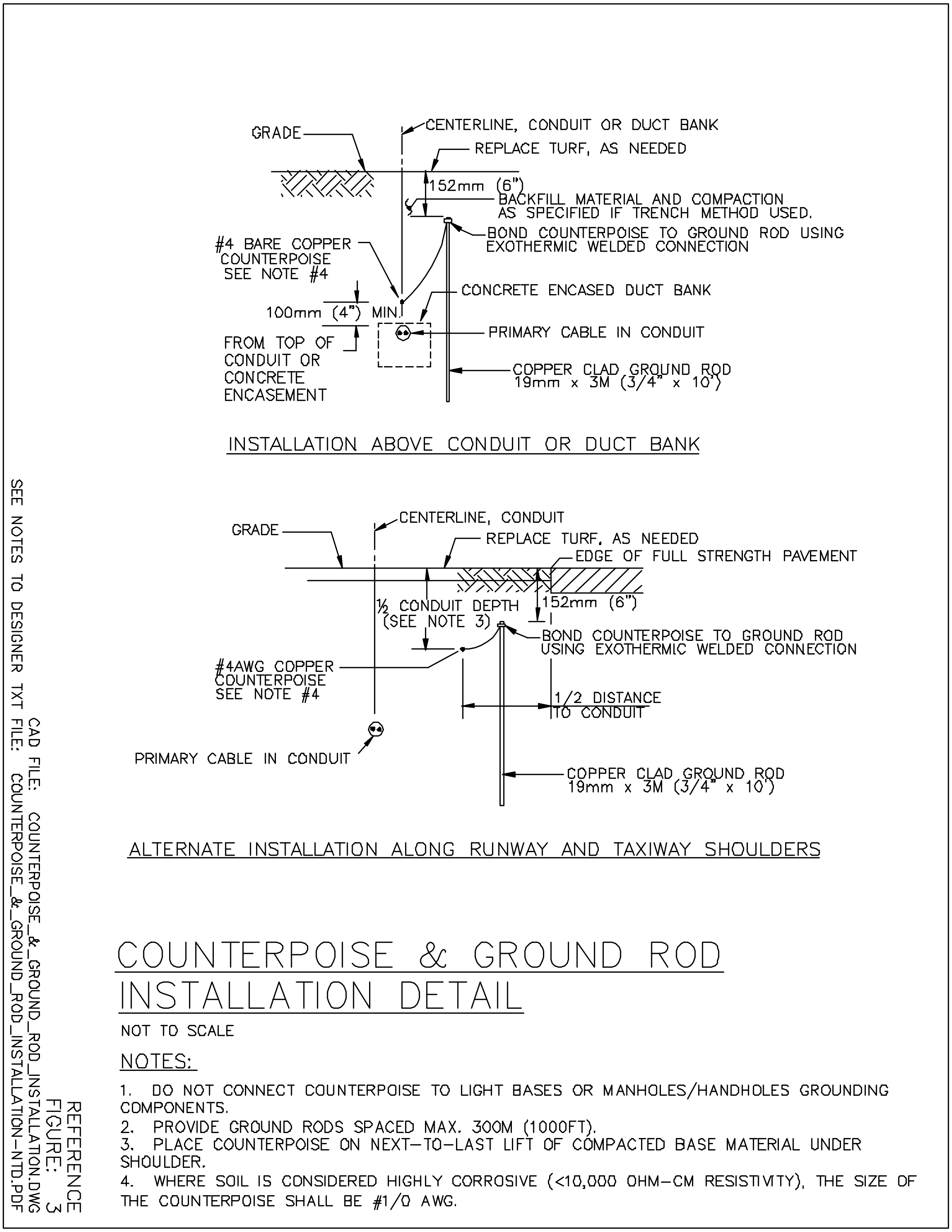


Figure 3. Counterpoise & Ground Rod Installation Detail

1.4. Duct Marker Installation at Pavement Edge

See figure 4.

Notes to Designer:

1. An option for installing the counterpoise would be to ground the counterpoise to a ground rod 1M (3') before the pavement and not install counterpoise over duct bank where duct run is beneath pavement.

2. The depth of the duct bank below pavement should be shown in the duct bank details.

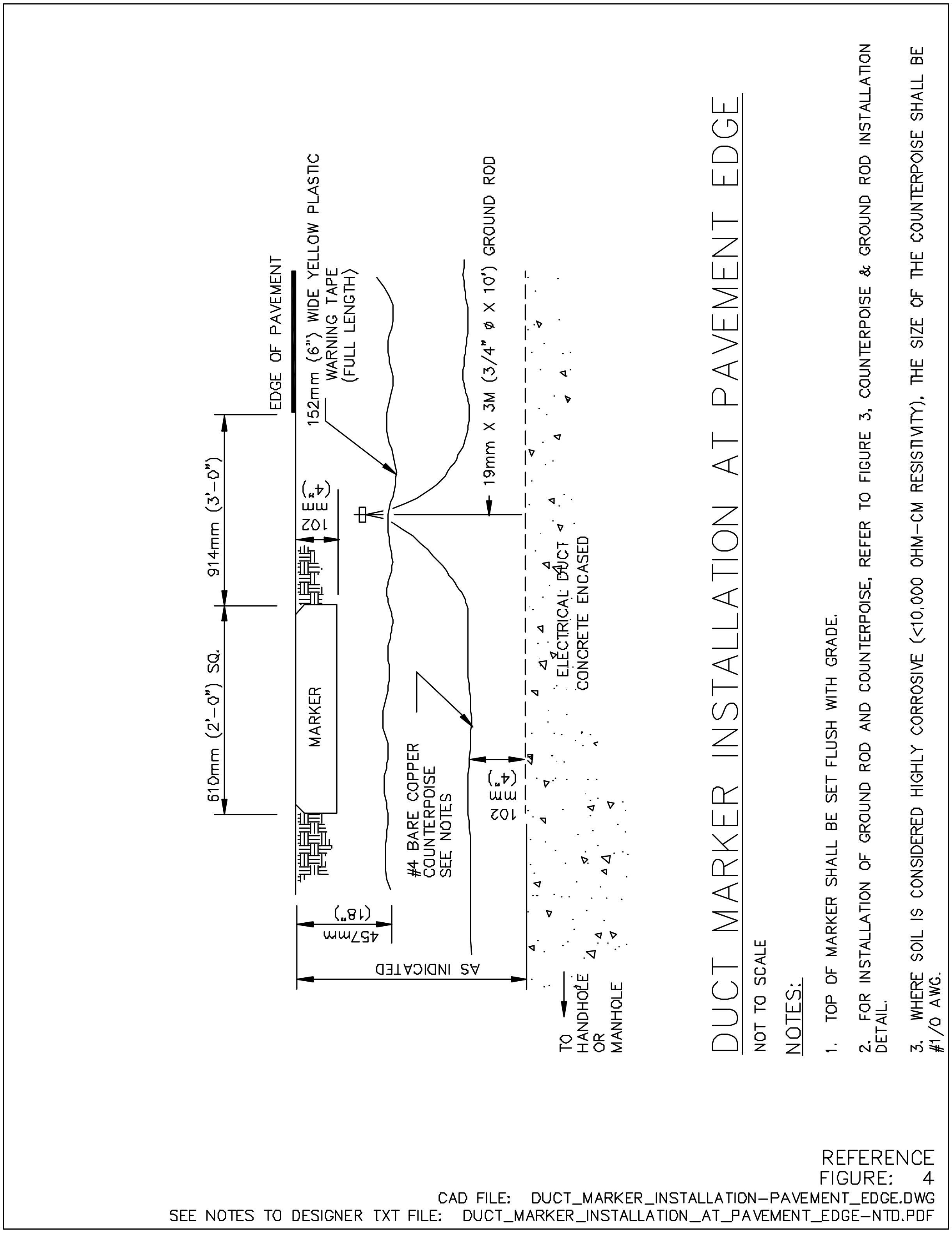


Figure 4. Duct Marker Installation at Pavement Edge

1.5. Cable and Duct Markers

See figure 5.

Notes to Designer:

1. Cable markers are placed directly over the cable trench with the arrows indicating direction of cable run. Maximum spacing of markers should not exceed 61M (200') plus every place the cable run changes direction. No markers are required where the cable runs in a straight line from light base to light base.

2. Duct markers are typically used at the edge of pavement to locate duct crossings beneath pavement. Where the entire lighting system is in ducts or conduit, locate the duct markers the same as cable markers.

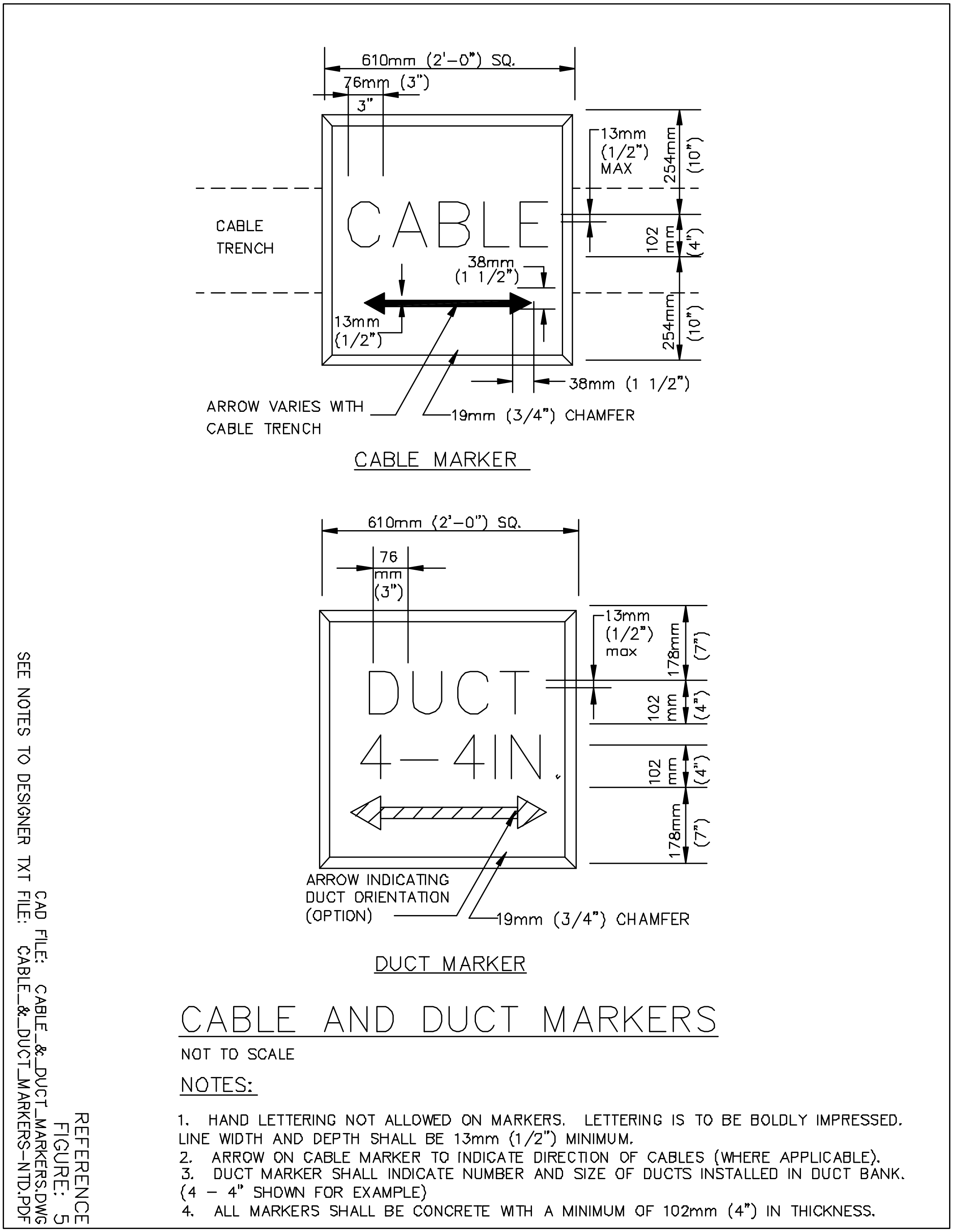


Figure 5. Cable and Duct Markers

1.6. Concrete Encased Duct Bank Details – Typical Arrangements

See figure 6.

Notes to Designer:

1. Stagger the couplings as shown to minimize weak points in the duct bank.

2. There are several types of duct spacers that will accomplish the required duct spacing. Some spacers allow for installation of several tiers on a single duct spacer thereby requiring less labor for installation.

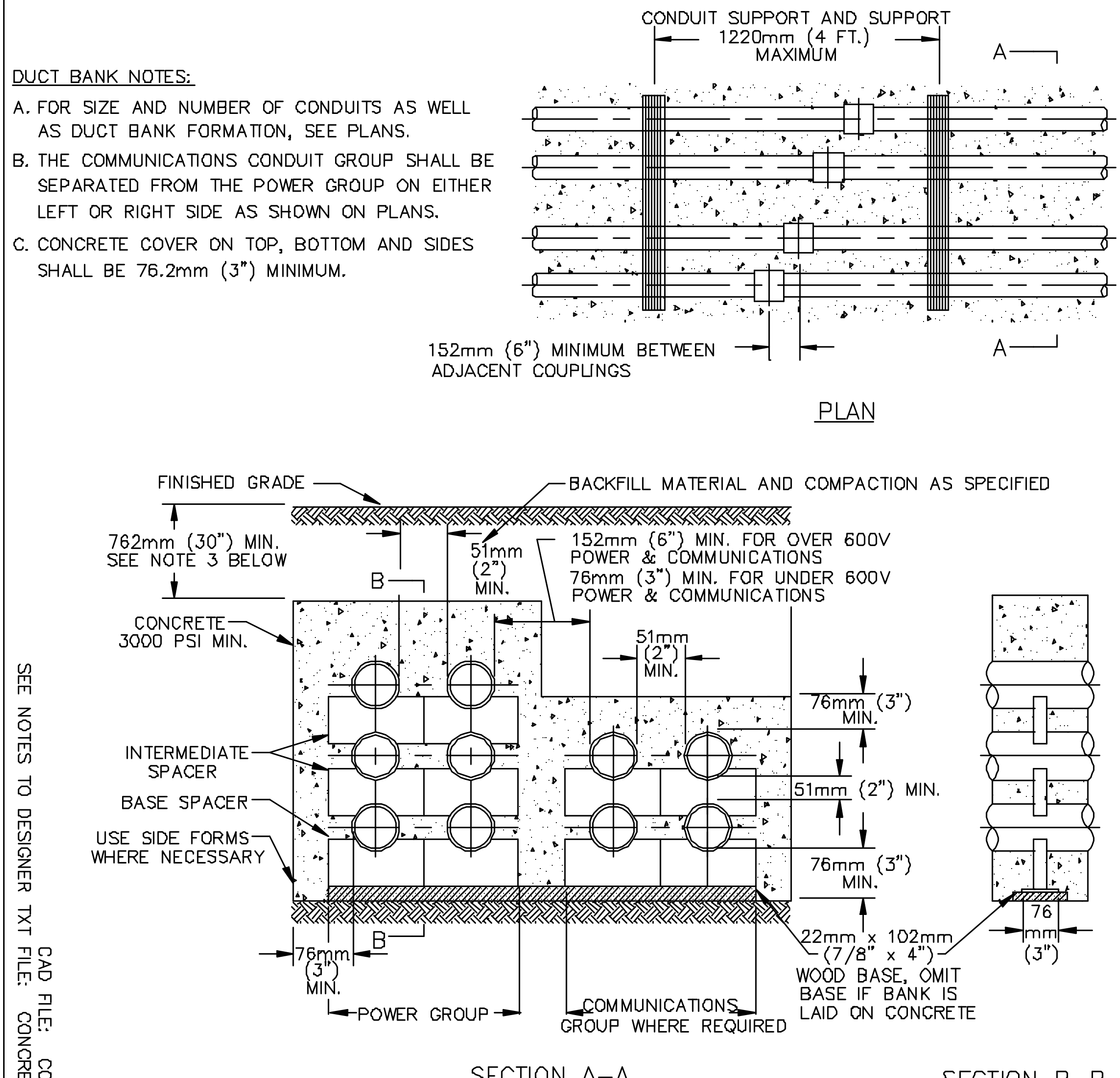
3. In areas of potential frost, it is recommended the minimum depth of the duct bank be at least 305mm (12") below frost line.

4. If there are no communication ducts intended, they may be deleted from the details.

5. Ducts should terminate in handholes, junction plaza (Air Force only), or manholes wherever possible. The handholes or manholes should be located outside of the runway or taxiway safety areas, if feasible.

6. Duct banks must slope towards drain.

7. Spacing of ducts shown is minimum in power group for series circuits. Refer to Figure 310-60 in the National Electric Code NFPA-70 when ducts are carrying parallel (constant voltage) AC circuits.



CONCRETE ENCASED DUCT BANK DETAILS – TYPICAL ARRANGEMENTS

NOT TO SCALE

NOTES:

1. FOR NON-METALLIC CONDUITS, TERMINATE WITH PLASTIC COUPLINGS SET FLUSH WITH END OF CONCRETE ENVELOPE AND INSTALL PLASTIC PLUGS. FOR METALLIC CONDUITS, TERMINATE WITH METALLIC COUPLINGS SET FLUSH WITH END OF CONCRETE ENVELOPE AND INSTALL WELL-GREASED PLUMBERS PLUGS OR THREADED PLASTIC PLUGS.
2. COUNTERPOISE AND WARNING TAPE NOT SHOWN FOR CLARITY.
3. MINIMUM DEPTH SHALL BE 762mm (30") OR 305mm (12") BELOW FROST LINE IN FROST SUSCEPTIBLE AREAS, WHICHEVER IS GREATER.

Figure 6. Concrete Encased Duct Bank Details – Typical Arrangements

1.7. Field Attached Plug-in Splice FAA Type L-823

See figure 7.

Notes to Designer:

1. It is recommended that single piece heat shrink tubing with sealant only at each end be utilized. Tubing with sealant coated on the entire interior will actually adhere to the L-823 connector thereby requiring a new connector be installed every time the splice is entered.

2. The cable ties act as an indicator to maintenance personnel for the location of the mating faces on the connector. When personnel want to re-enter the splice, the tubing is cut between the two ridges formed by the cable ties. Each piece of the tubing may now be rolled back to expose the connector. To re-seal the splice, the old tubing is removed and a new piece of heat shrink with sealant at ends is installed over the connector.

3. Shapes of L-823 splice connectors vary with manufacturer. One particular manufacturer (Amerace, Ltd.) has designed a new type of seal and does not recommend the use of heat shrink. Tape is used around the mating face overlap to keep out dirt. The designer should contact several FAA approved manufacturers of L-823 splice connectors and become familiar with their recommended installation requirements.

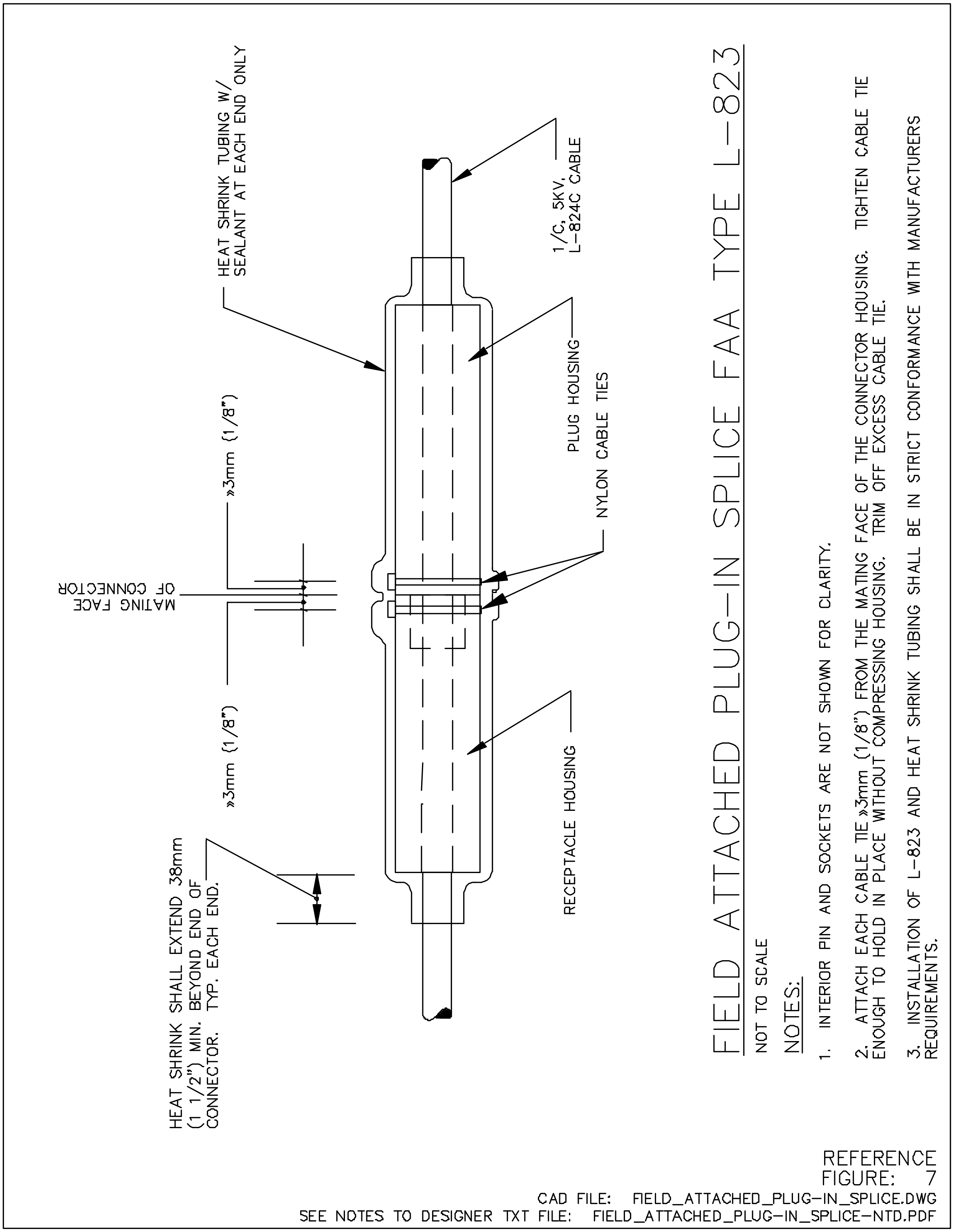


Figure 7. Field Attached Plug-in Splice FAA Type L-823

Chapter 2: RUNWAY AND TAXIWAY LIGHTING

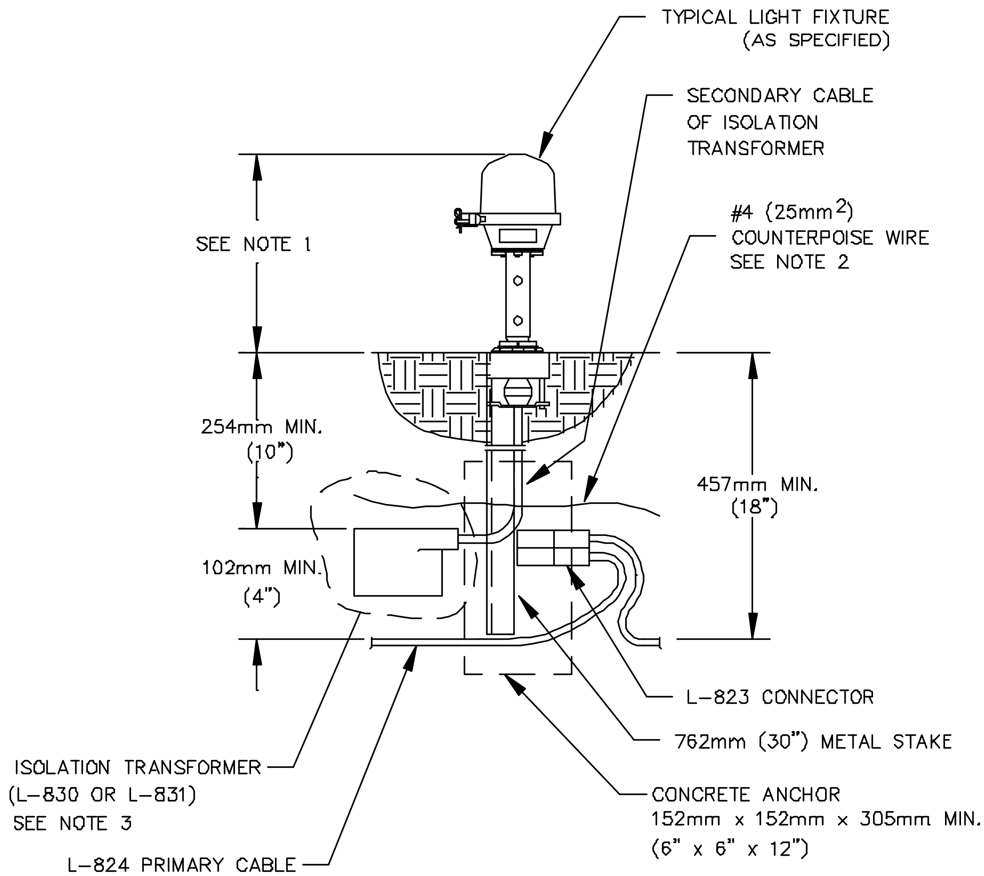
2.1. Stake Mounted Elevated Fixture Installation

See figure 8.

Notes to Designer:

1. The preferred method for mounting elevated lights is the base mounting installation. The stake mounting may be used as a temporary installation. The concrete anchor as shown in the detail may be deleted in a temporary installation. In some cases the stake mounted method could be used as a permanent installation depending on project design criteria. In these cases the concrete anchor is required.

2. The 762mm (30") stake acts as a ground rod for grounding the fixture assembly.



STAKE MOUNTED ELEVATED FIXTURE INSTALLATION

NOT TO SCALE

FOR TEMPORARY INSTALLATION ONLY

NOTES:

1. STANDARD HEIGHT IS 356mm (14"). HEIGHT MAY BE ADJUSTED PER FIGURE 10 IN AREAS SUBJECT TO SNOW CONDITIONS.

2. ROUTE COUNTERPOISE AROUND STAKE TOWARDS PAVEMENT. DO NOT CONNECT TO STAKE.

3. TRANSFORMER AND SLACK CABLES SHALL BE PLACED ON A BED OF SAND AND COVERED WITH SAND SUCH THAT TRANSFORMER AND SLACK CABLES ARE SURROUNDED WITH MIN. 102mm (4") SAND BACKFILL

REFERENCE
FIGURE: 8
CAD FILE: STAKE_MOUNTED_ELEVATED_FIXTURE_INSTALLATION.DWG
SEE NOTES TO DESIGNER TXT FILE: STAKE_MOUNTED_ELEVATED_FIXTURE_INSTALLATION-NTD.PDF

Figure 8. Stake Mounted Elevated Fixture Installation

2.2. Base Mounted Elevated Fixture Installation

See figure 9.

Notes to Designer:

1. The flexible conduit allows for minor adjustments in alignment during installation and also allows flexibility of the conduit runs during freeze/thaw cycles in cold climates. The conduit shall meet the requirements of NEMA TC12 and should be at least 305mm (12") long.

2. Many contractors will purchase the L-867 bases and send them to pre-cast shops for the concrete encasement. The conduit stubs are slid through the grommets prior to casting. A minimum of 152mm (6") should be protruding from the encasement to allow the installation of the conduit couplings.

3. Some installations have underdrains around the runway or taxiway. The designer should review the profile of the lighting system together with the profile of the pavement. Bases at the low point should be ordered with an additional hub and connect a 50mm (2") conduit between the underdrain and the light base. Where there is no underdrain installed the conduit may run to the closest storm water catch basin. Maintain slope such that water drains out of light base toward underdrain or catch basin.

4. The equipment ground routed to each base via the conduit system shall be connected to the system ground at the lighting vault.

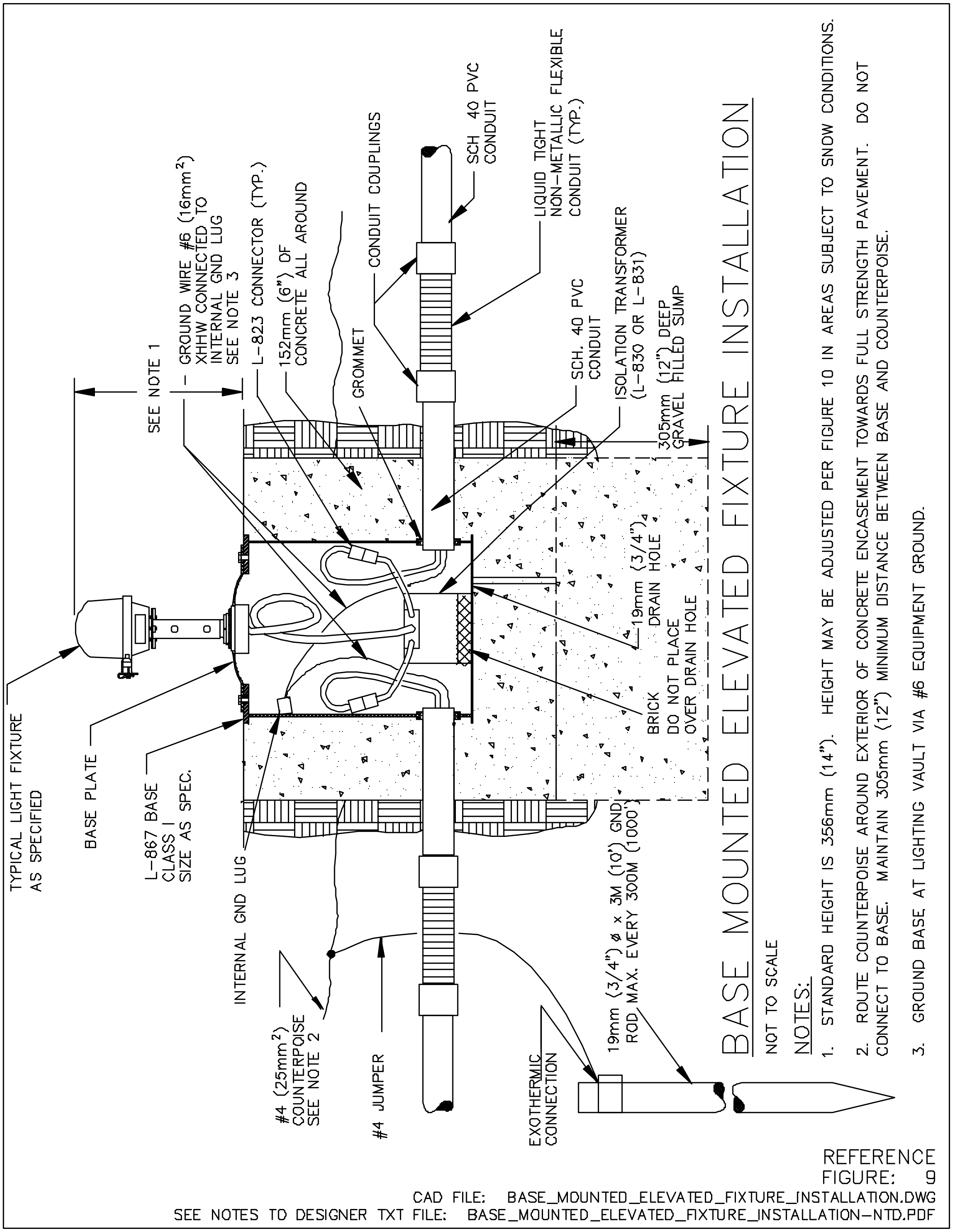


Figure 9. Base Mounted Elevated Fixture Installation

2.3. Adjustment of Edge Light Elevation Due to Snow Conditions

See figure 10.

Notes to Designer:

1. As indicated in the detail, the edge lights may be increased in height above the standard elevation in areas where the snowfall exceeds 0.6M (2'). However, this adjustment may only be made as the light is moved outward from 1.5M (5') to 3M (10'). Lights mounted at 1.5M (5') from pavement edge shall be a maximum of 356mm (14") above grade.

2. Typically, the lights are mounted at the 3M (10') distance on runways used by jet aircraft to avoid possible damage by jet blasts.

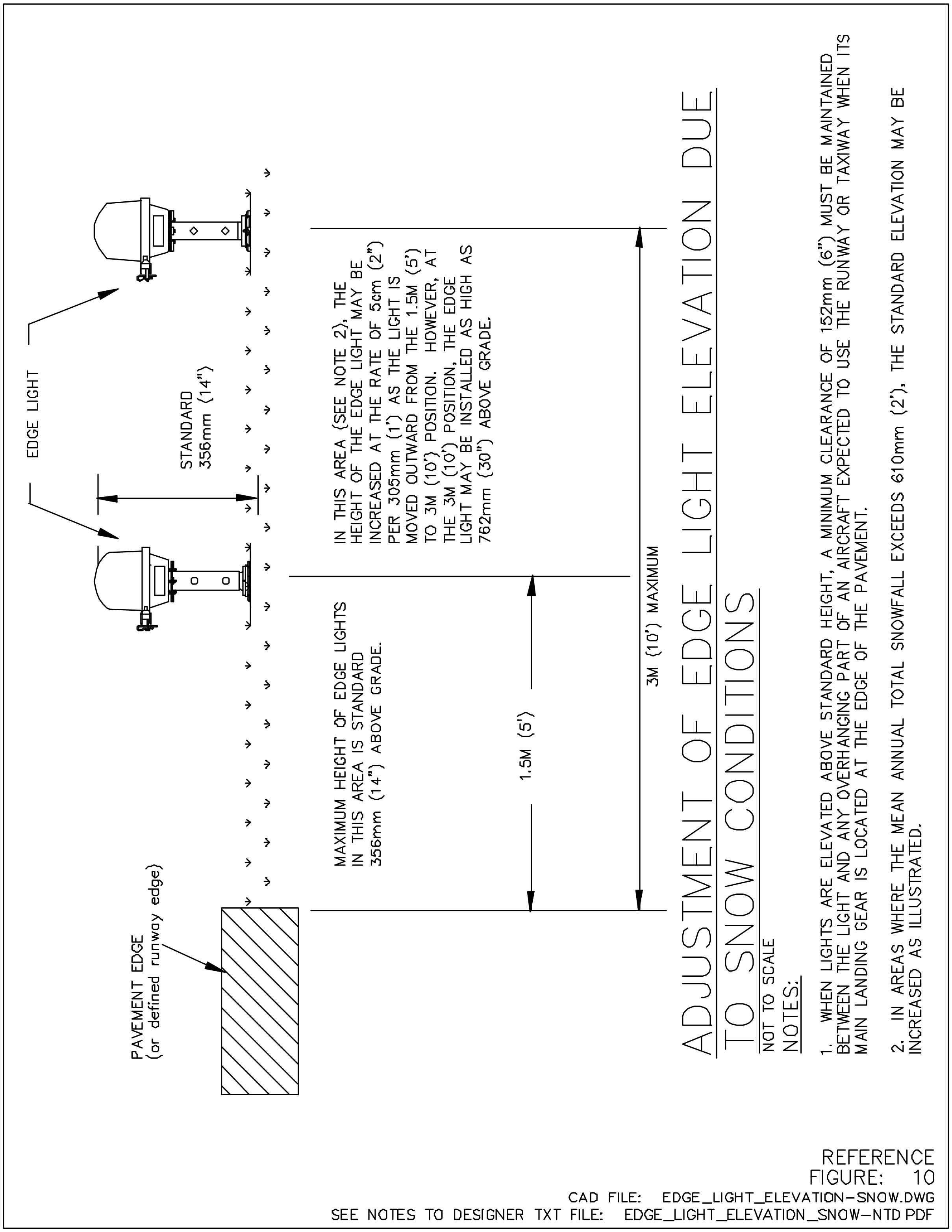


Figure 10. Adjustment of Edge Light Elevation Due to Snow Conditions

2.4. Semiflush Runway Light (Deep Base)

See figure 11.

Notes to Designer:

1. All semiflush in-pavement lights should be installed on a load-bearing base FAA type L-868. The diameter of the base will depend on the fixture manufacturer and type of fixture being installed.

2. It is recommended that the fixture be set inside a flange ring that has an integral pavement ring. Spacer rings (or shims) should be set on top of the base and the flange ring will mount on top of the spacer rings. This allows lowering of the fixture in flexible pavements if the pavement is slumping. A maximum of 2 spacer rings should be used.

3. The sealing compound must be compatible with the type of pavement being installed and the contractor must follow the manufacturer's preparation instructions.

4. The "deep can" method is preferred in new construction with the isolation transformers for the in-pavement fixture housed within the base (can).

5. It is recommended that the designer review the profile of the in-pavement lighting system and provide drainage at the low points in the same manner as the edge lighting system.

6. Installation methods for semiflush fixtures are also contained in advisory circular AC 150/5340-4c, Installation Details for Runway Centerline and Touchdown Lighting Systems.

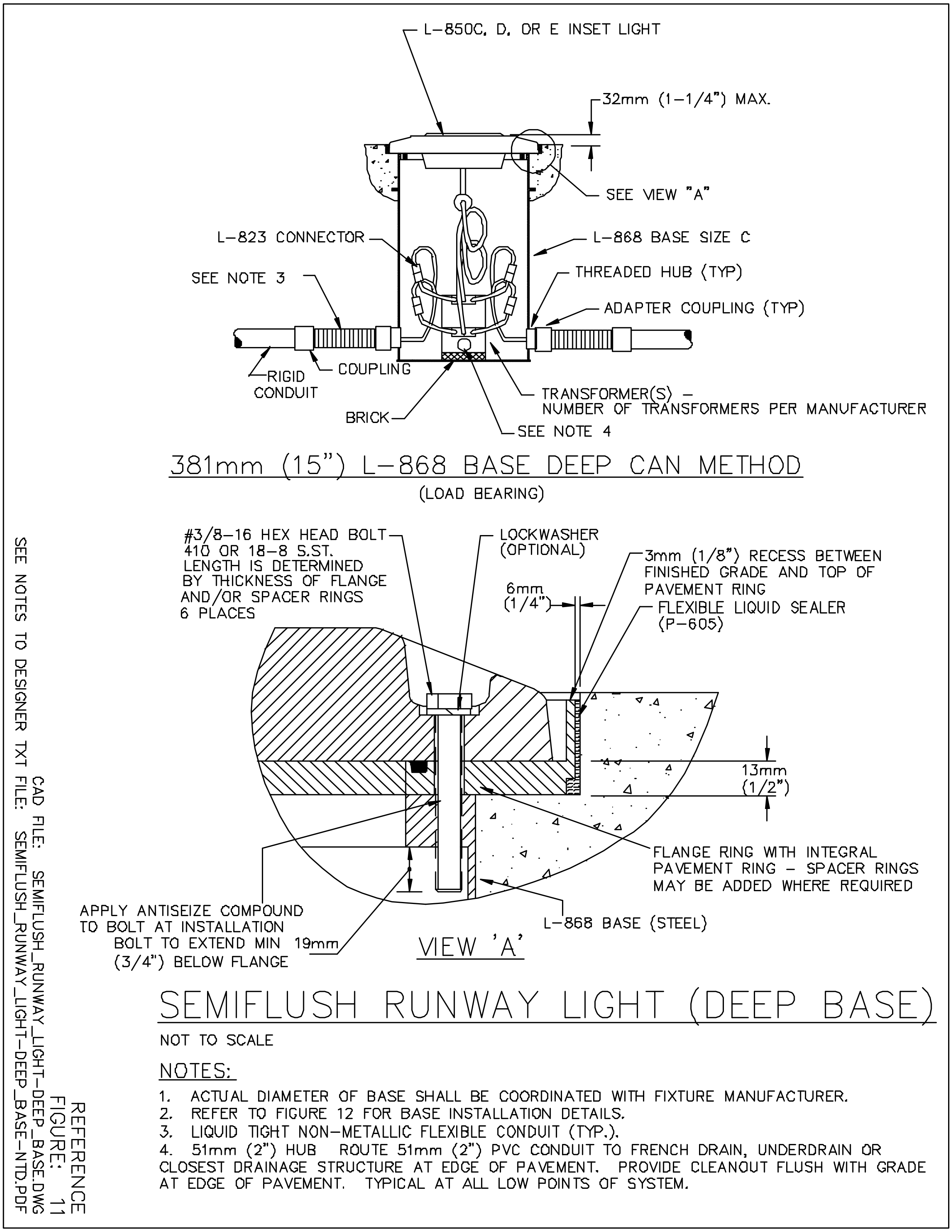


Figure 11. Semiflush Runway Light (Deep Base)

2.5. Base and Anchor Details (New Construction)

See figure 12.

Notes to Designer:

1. Construction methods will be specified in the project specifications for the type of pavement. Details should be shown on the drawings in enough detail to complement the specifications.

2. Preparation for the base and anchor in either rigid or flexible pavement is the same. At each light location a hole is excavated in the sub base which will be minimum 305mm (12") wider than the light base and 152mm (6") below the bottom of the light base. A trench is excavated between the light base locations for the conduit. Depth of the trench must provide a minimum 51mm (2") cover over and 76mm (3") below the conduit and also allow the conduit to enter the base at the proper elevation.

3. A single section light base is used in rigid pavements and a two or three section light base (depending on pavement depth and lifts) will be used in flexible pavements.

4. The flexible conduit allows for minor base adjustments before the concrete anchor hardens.

5. A tie bar cage (#4 deformed) is installed around the light base in rigid pavement.

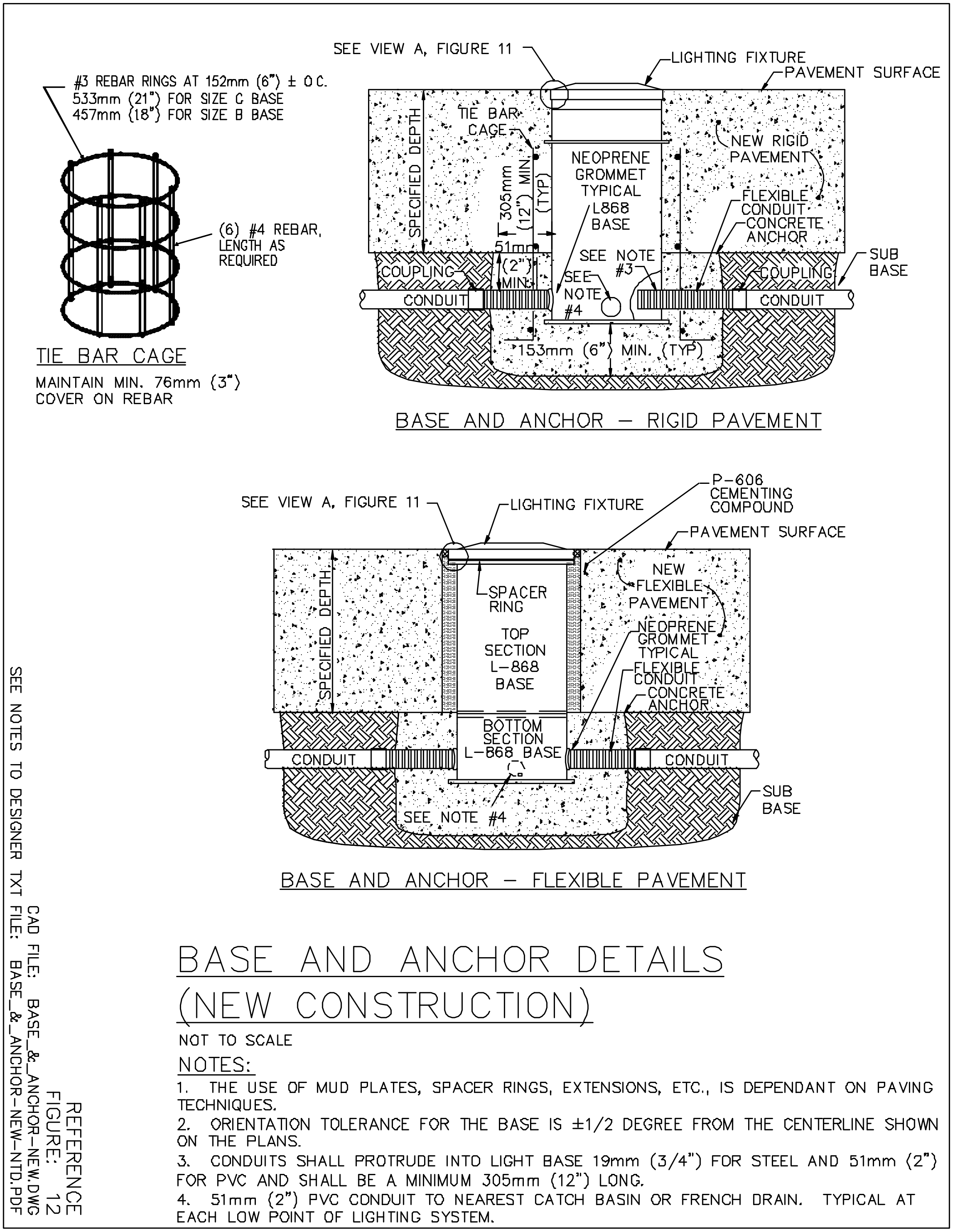


Figure 12. Base and Anchor Details (New Construction)

2.6. Deep Base Installation (New Construction), Rigid Pavement

See figure 13.

Notes to Designer:

1. Light location, elevation, azimuth (direction of the light beam measured in a horizontal plane) is extremely critical. It is recommended that contract documents require all points for setting the lights be accomplished by survey and a mandatory construction meeting be included with representatives from the A/E team, contractor, government and field personnel. The purpose of this meeting will be to review the proposed construction techniques.

2. The installation of the alignment jig shall be per the base manufacturer's requirements.

3. Once the light bases are set at the correct elevation, the conduit is installed between the bases and the tie bare cages are formed around the base. The concrete anchor is poured around the base and along the conduit trench. Instruct the contractor to ensure that all voids or loose material beneath the conduit have been eliminated prior to encasing in concrete. Concrete should be flush with sub base and not protrude above sub base.

4. Once the concrete has cured approximately 24 hrs., the jig may be removed.

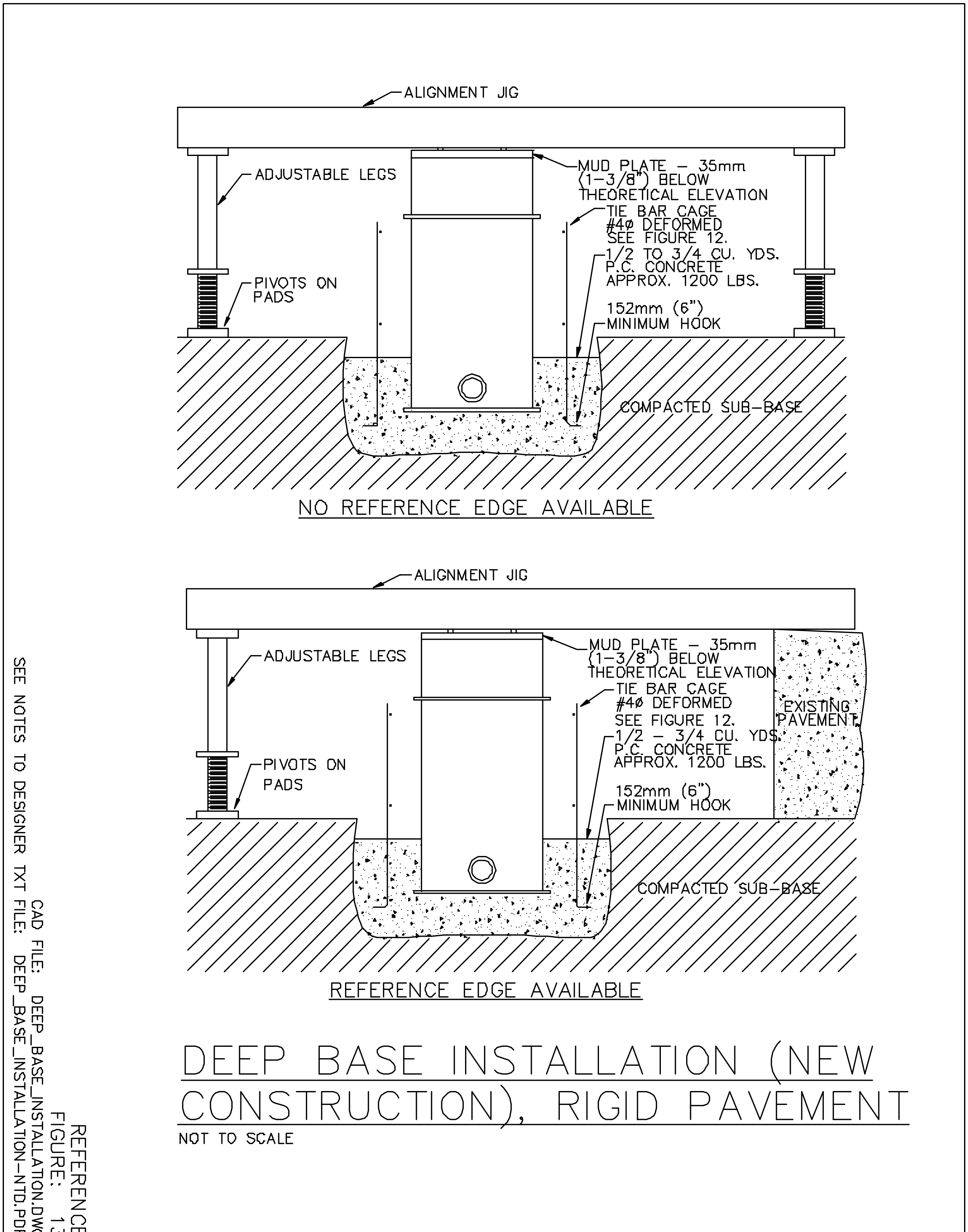


Figure 13. Deep Base Installation (New Construction), Rigid Pavement

2.7. Flexible Pavement or Overlay (Flexible, Rigid) Installation

See figure 14.

Notes to Designer:

1. Installation in flexible pavement is similar to rigid except a sectional base is used and there is no tie bar cage.

2. The bottom section of the light base is set at an elevation such that the top of the plywood cover and mud plate is flush with the surrounding base. The concrete anchor is poured and allowed to cure for 24 hours.

3. The jig may then be removed and paving operations may be accomplished.

4. Ensure contractor core drills the light bases after compaction has been completed and the pavement has been accepted.

5. The rigid P-606 is used to firmly set the top section or base extension in place and bond to pavement. The flexible P-605 is installed from the top of the top section or base extension to the top of the finished pavement surface. This allows future adjustment of the fixture by removing or adding spacer rings without disruption of the base. Both P-606 and P-605 must be specified as being compatible with type of pavement being installed.

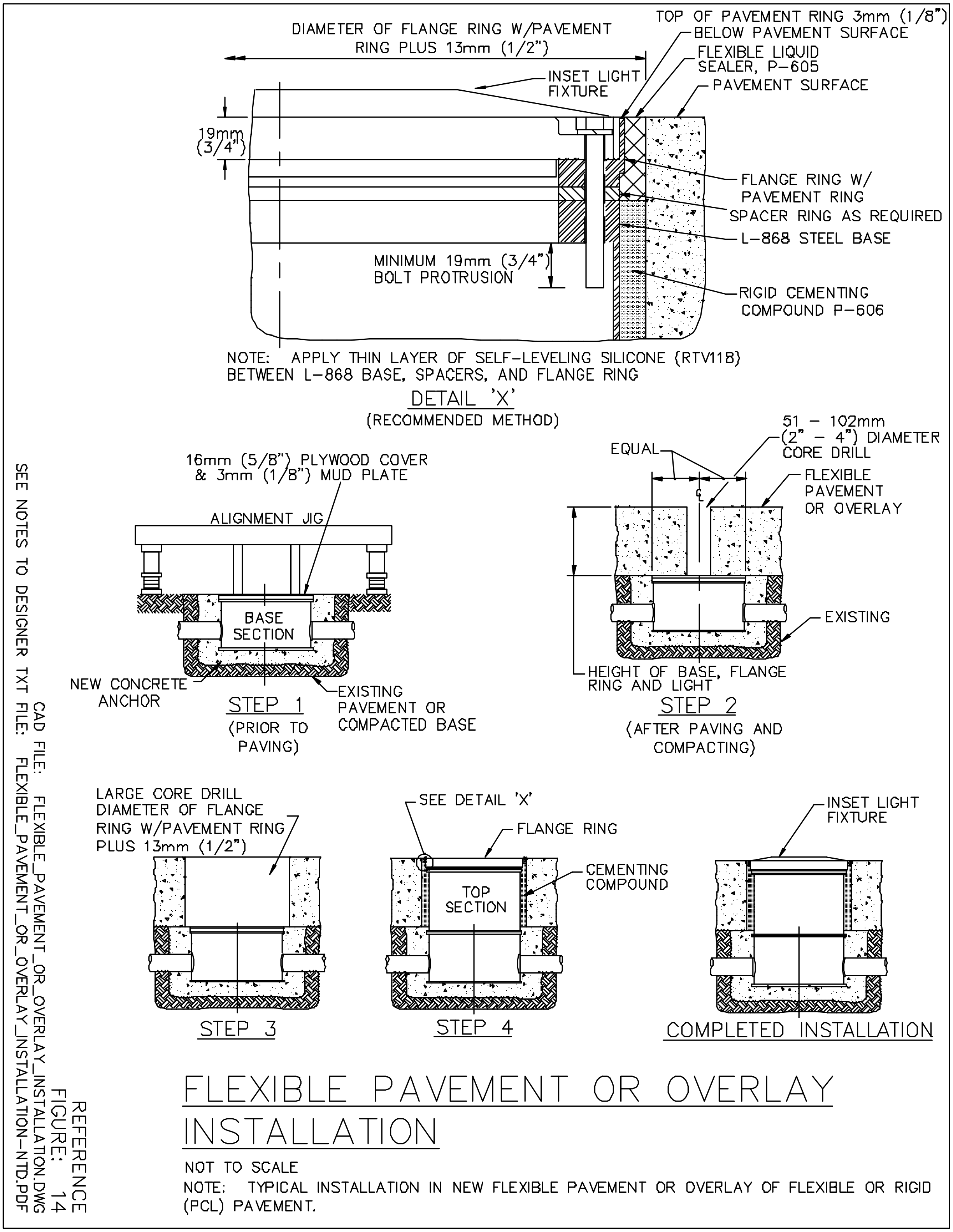


Figure 14. Flexible Pavement or Overlay Installation

2.8. Saw Kerf Wireway Details – R/W Centerline and TDZ Lights

See figure 15.

Notes to Designer:

1. The preferred method for installation of runway centerline and touchdown zone (TDZ) lights in new construction is to utilize deep base housing; the individual isolation transformer and each base connected by a conduit system. Installation of lights in existing pavement utilizes shallow bases for the lights. The secondary wiring from the lights are run in a saw kerf to the side of the runway and into an L-867 base which houses the isolation transformer(s) for the lights.

2. The pavement is core drilled to a depth and diameter recommended by the fixture manufacturer. The fixture is then "glued-in" utilizing sealant that is chemically compatible with the pavement. It is extremely important to specify the proper sealant to prevent possible separation. A shallow base with anti-rotational fins and pavement anchors is recommended. Some problems have been encountered with the "direct mounted" type fixtures that have a smooth exterior finish.

3. More recent installations have been utilizing conduit for the secondary wiring in lieu of installing the wires directly in the saw kerf. If conduit is used, a water tight seal where the conduit enters the base must be specified.

4. The backer rod in the saw kerf serves three purposes. It acts as a shock absorber, it keeps the wiring in the saw kerf, and it acts as a sealant dam so if the wiring has to be changed they aren't encased in the sealant.

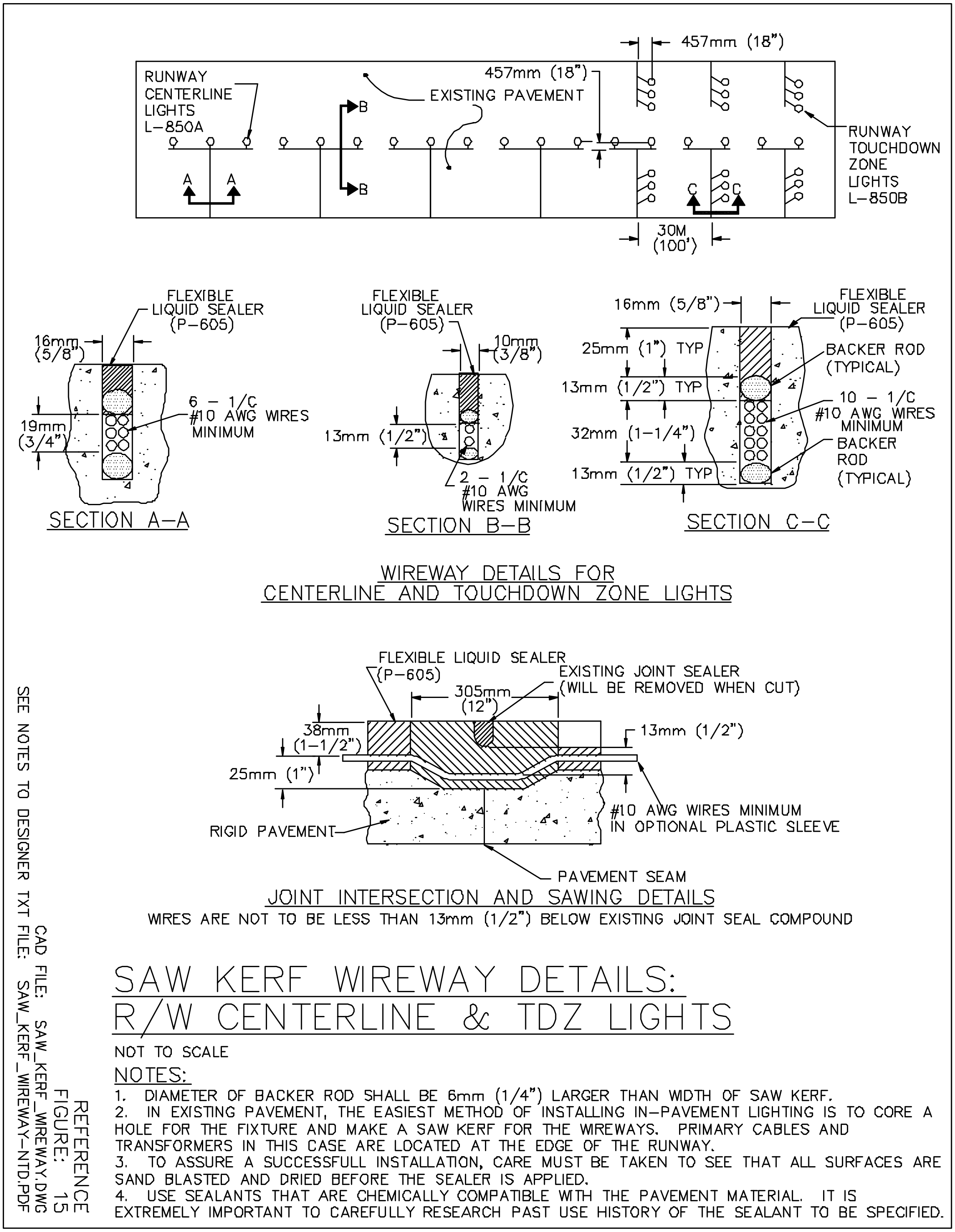


Figure 15. Saw Kerf Wireway Details – R/W Centerline and TDZ Lights

2.9. Saw Kerf Orientation Details – R/W Centerline and TDZ Lights

See figure 16.

Notes to Designer:

1. Additional information may be found in FAA Advisory Circular AC 150/5340-4c, Installation Details for Runway Centerline and Touchdown Lighting Systems.

2. It is recommended to install the secondary conductors without any splices. However, where splices are unavoidable they may be installed in an L-869 junction box as outlined in AC 150/5340-4c.

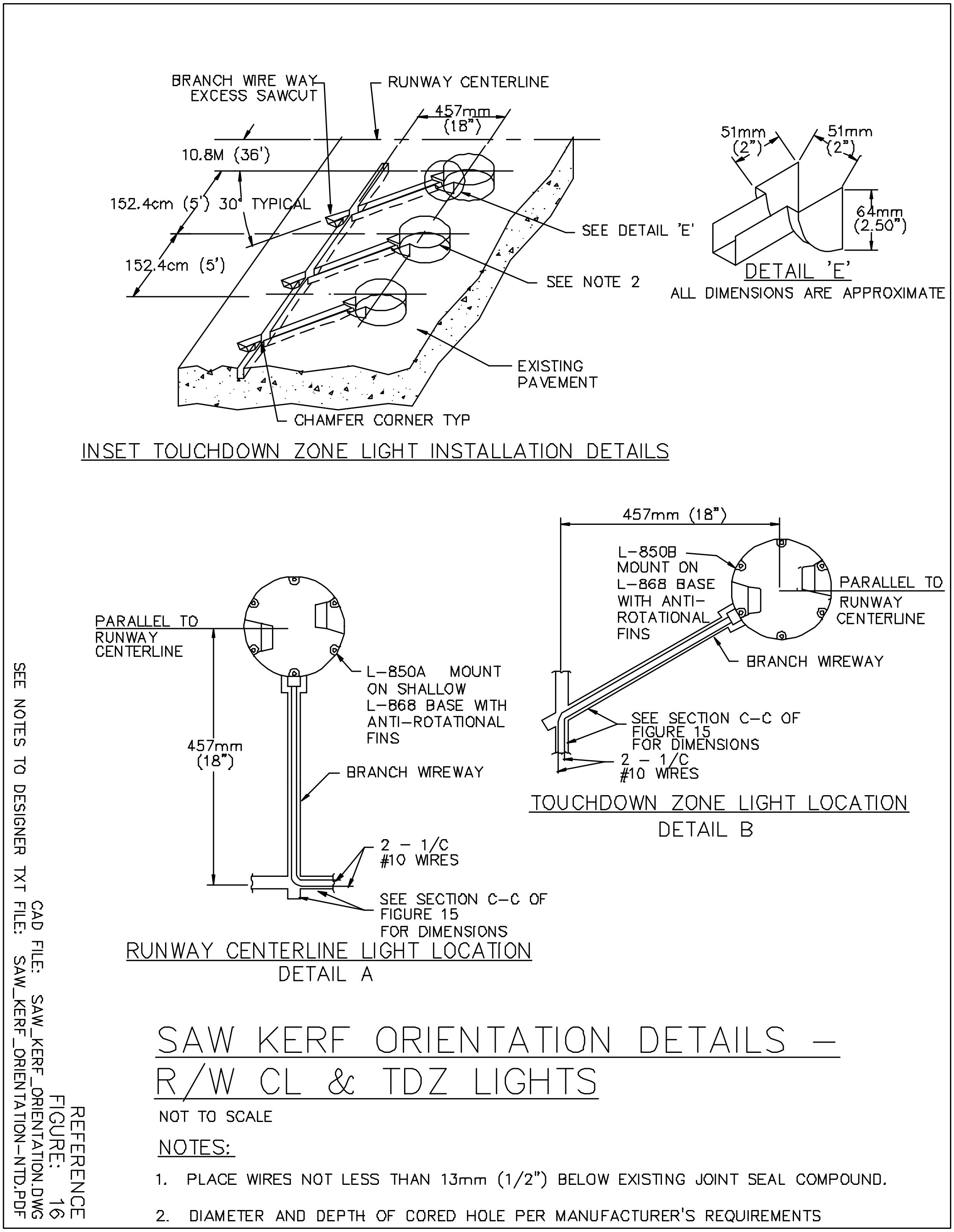


Figure 16. Saw Kerf Orientation Details – R/W Centerline and TDZ Lights

2.10. Runway Centerline Light – Shallow Base and Conduit Installation

See figure 17.

Notes to Designer:

1. More and more installations have been utilizing conduit for the secondary conductors. If conduit is used a water tight seal where the conduit enters the base must be specified.

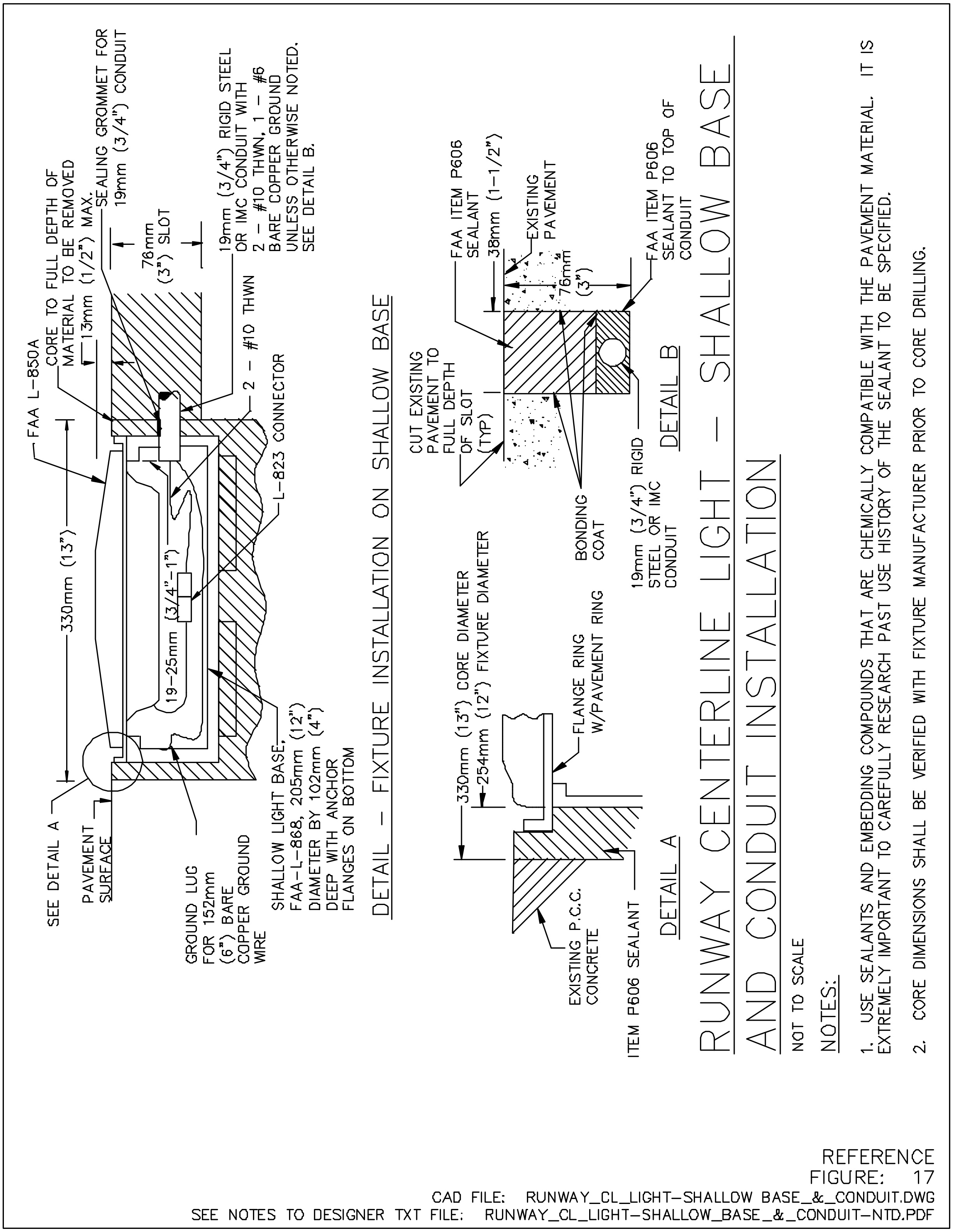


Figure 17. Runway Centerline Light – Shallow Base and Conduit Installation

2.11. Semiflush Shallow Base Runway Edge End or Threshold Light

See figure 18.

Notes to Designer:

1. This detail shows one particular manufacturer's shallow base. However, recommend specifying the base with anti-rotational and anchoring fins or specify the fixture manufacturer demonstrate the base will not rotate or separate from the embedding material.

2. Recommend stating in basis of design the particular fixture manufacturer the design was based on.

3. Deep base installation is the preferred installation method. Recommend prior approval for this installation before design.

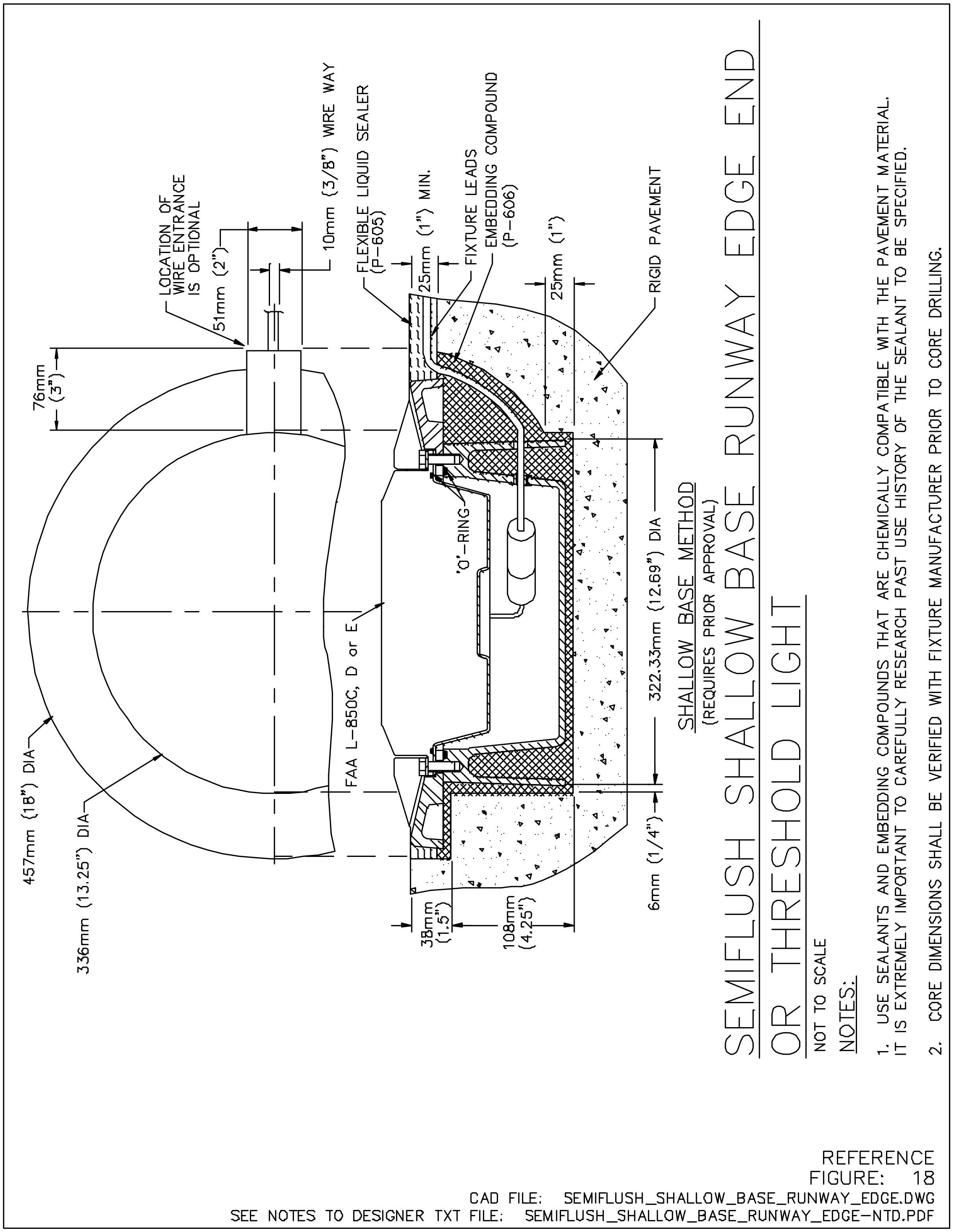


Figure 18. Semiflush Shallow Base Runway Edge End or Threshold Light

2.12. Semiflush Shallow Base Runway Centerline or TDZ Light

See figure 19.

Notes to Designer:

1. This detail shows one particular manufacturer's shallow base. However, recommend specifying the base with anti-rotational and anti-lift fins or specify the fixture manufacturer demonstrate the base will not rotate or separate from the embedding material.

2. Recommend stating in basis of design the particular fixture manufacturer the design was based on.

3. Deep base installation is the preferred installation method. Recommend prior approval for this installation before design.

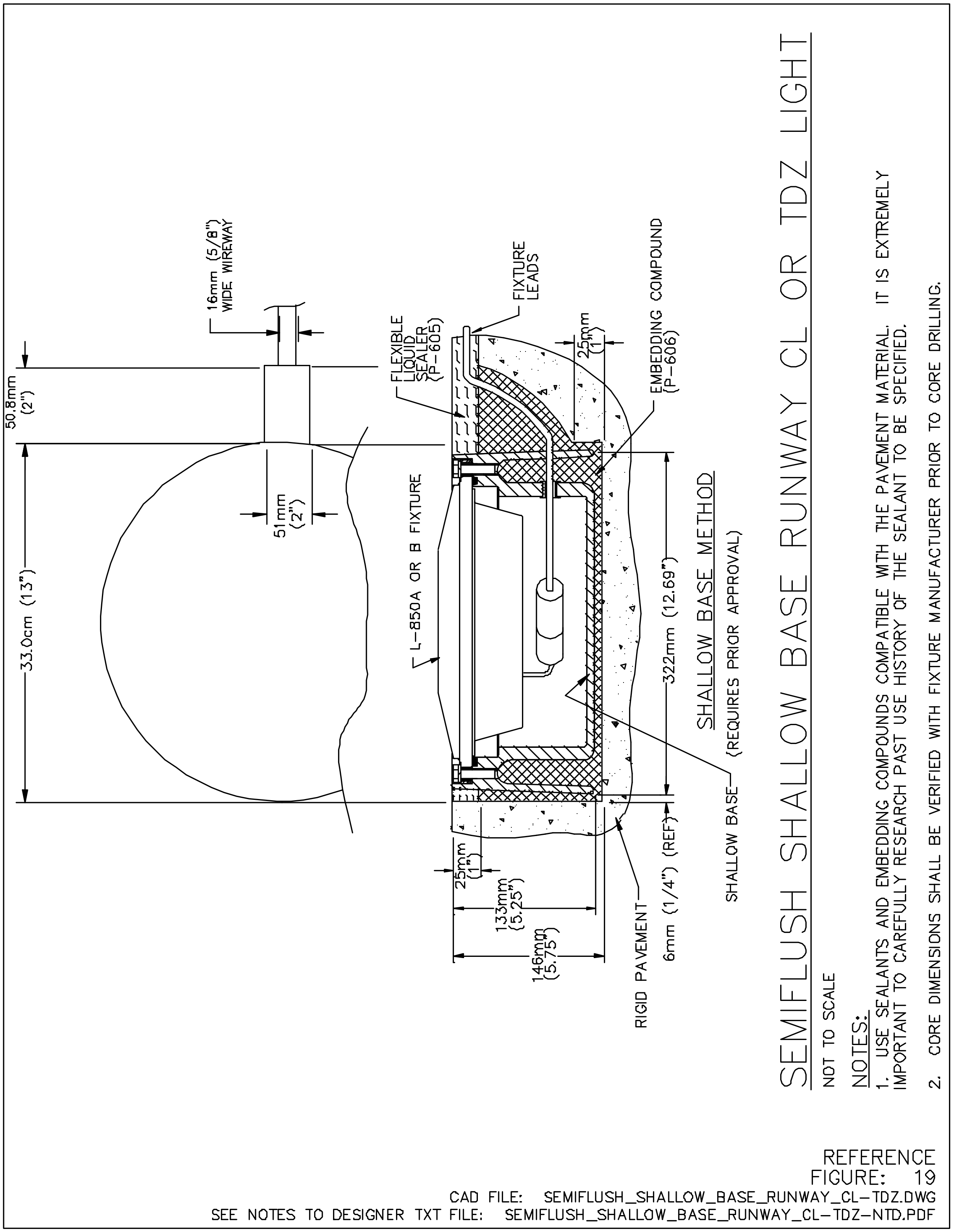


Figure 19. Semiflush Shallow Base Runway Centerline or TDZ Light

2.13. Taxiway Centerline Lights Wiring Methods

See figure 20.

Notes to Designer:

1. Additional information on taxiway centerline lighting may be found in FAA Advisory Circular AC 150/5340-28, Low Visibility Taxiway Lighting Systems.

2. Installation of wiring in saw kerfs is similar to the methods used for other in-pavement fixtures.

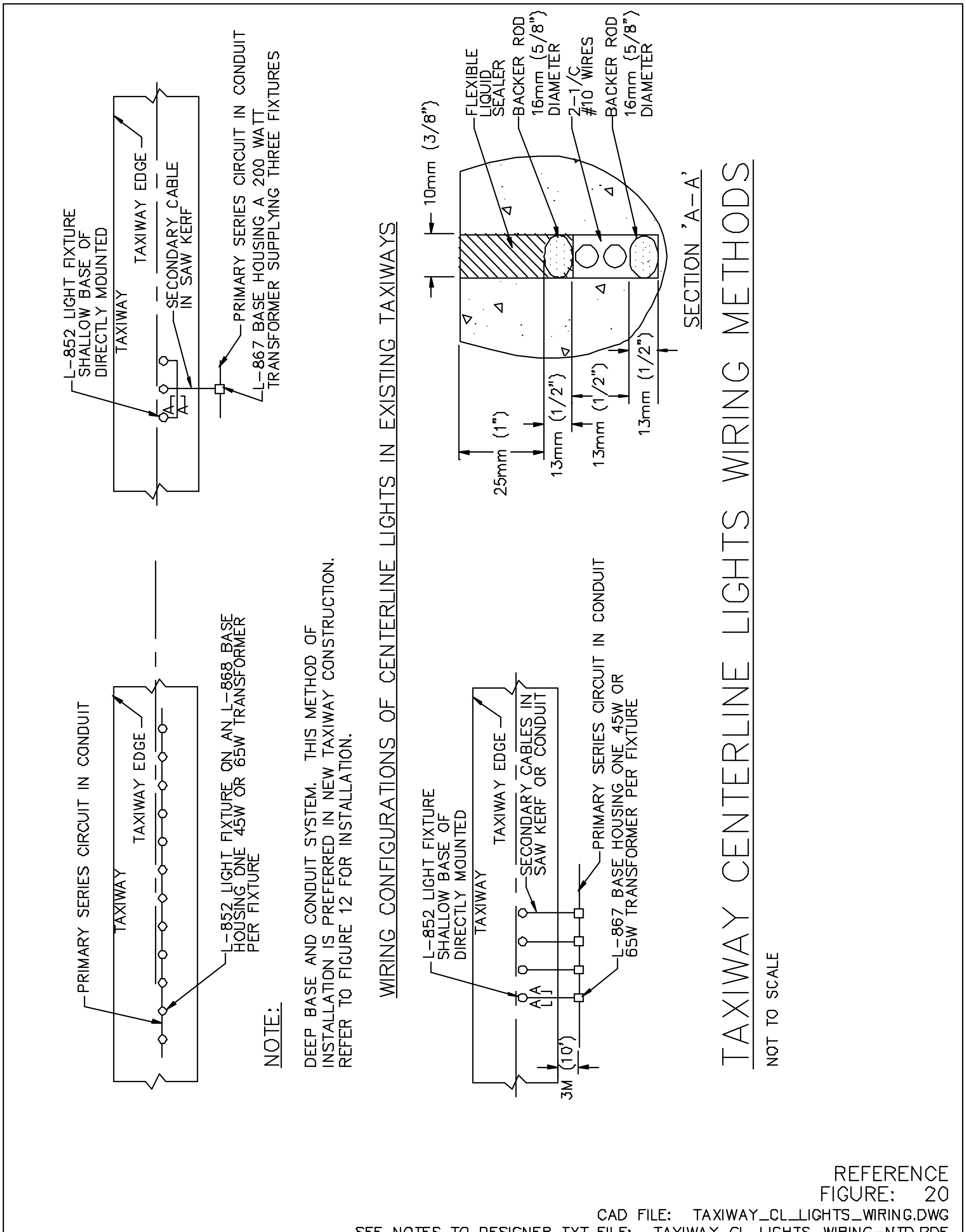


Figure 20. Taxiway Centerline Lights Wiring Methods

2.14. Semiflush Shallow Base Taxiway Centerline Light

See figure 21.

Notes to Designer:

1. This detail shows one particular manufacturer's shallow base. However, recommend specifying the base with anti-rotational and anti-lift fins or specify the fixture manufacturer demonstrate the base will not rotate or separate from the embedding material.

2. Recommend stating in basis of design the particular fixture manufacturer the design was based on.

3. Deep base installation is the preferred installation method. Recommend prior approval for this installation before design.

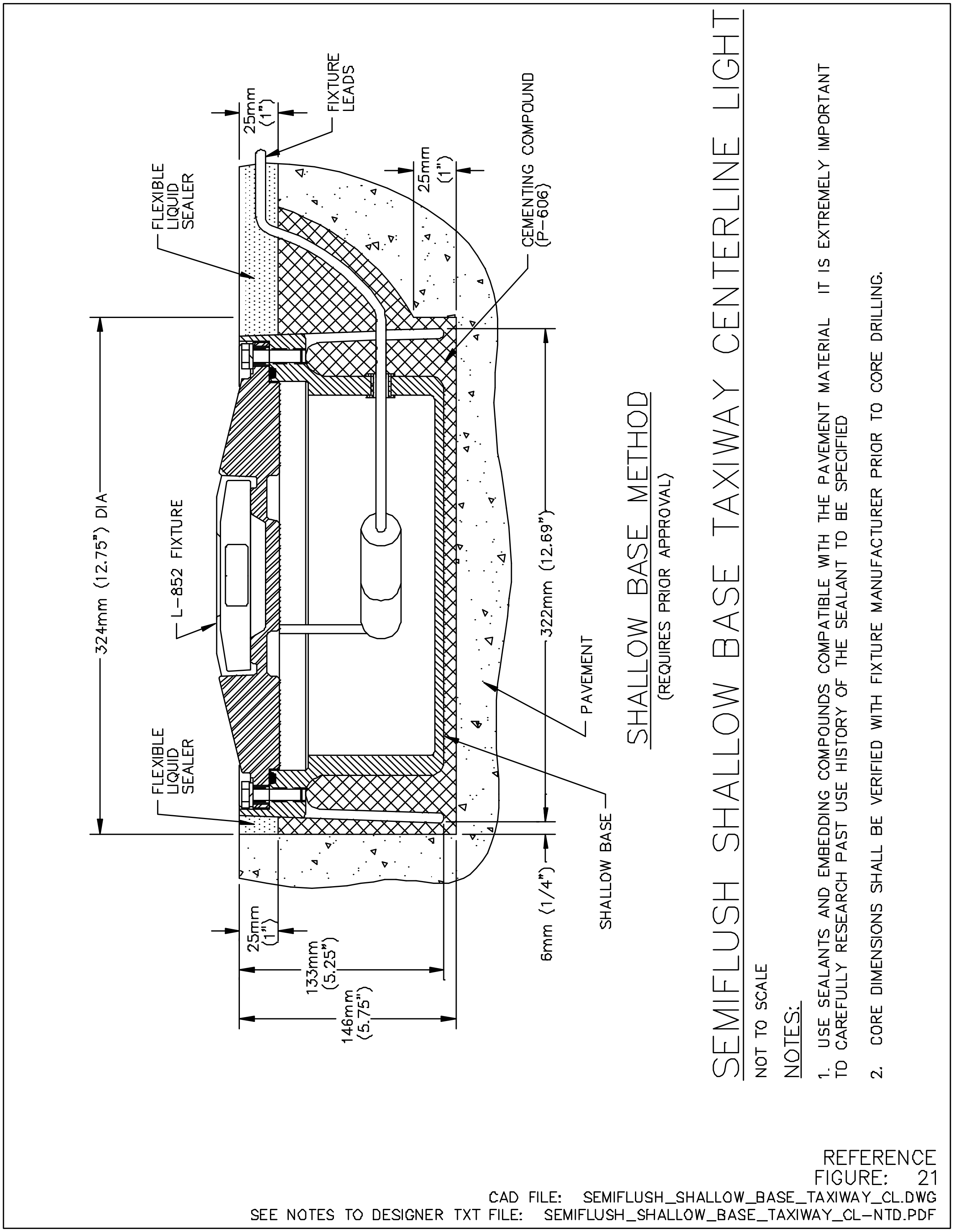


Figure 21. Semiflush Shallow Base Taxiway Centerline Light

2.15. Typical Touchdown Zone Light Wiring Details

See figure 22.

Notes to Designer:

1. Refer to Volume I for circuiting considerations.

2. The monitoring requirements for Cat II and III runways require the number of lamps out to be monitored. The use of lamp shorting devices, either relay or film disk type, must be avoided for monitoring system to successfully detect lamps out. Fixtures connected with lamps in series won't be able to be monitored if shorting devices are employed.

3. Monitoring and control systems exist that utilize existing load cables to communicate via power line carrier technology. Individual lamp control and status monitoring can be achieved with these systems. System computers in vault can communicate control and load status signals to control tower or other remote locations.

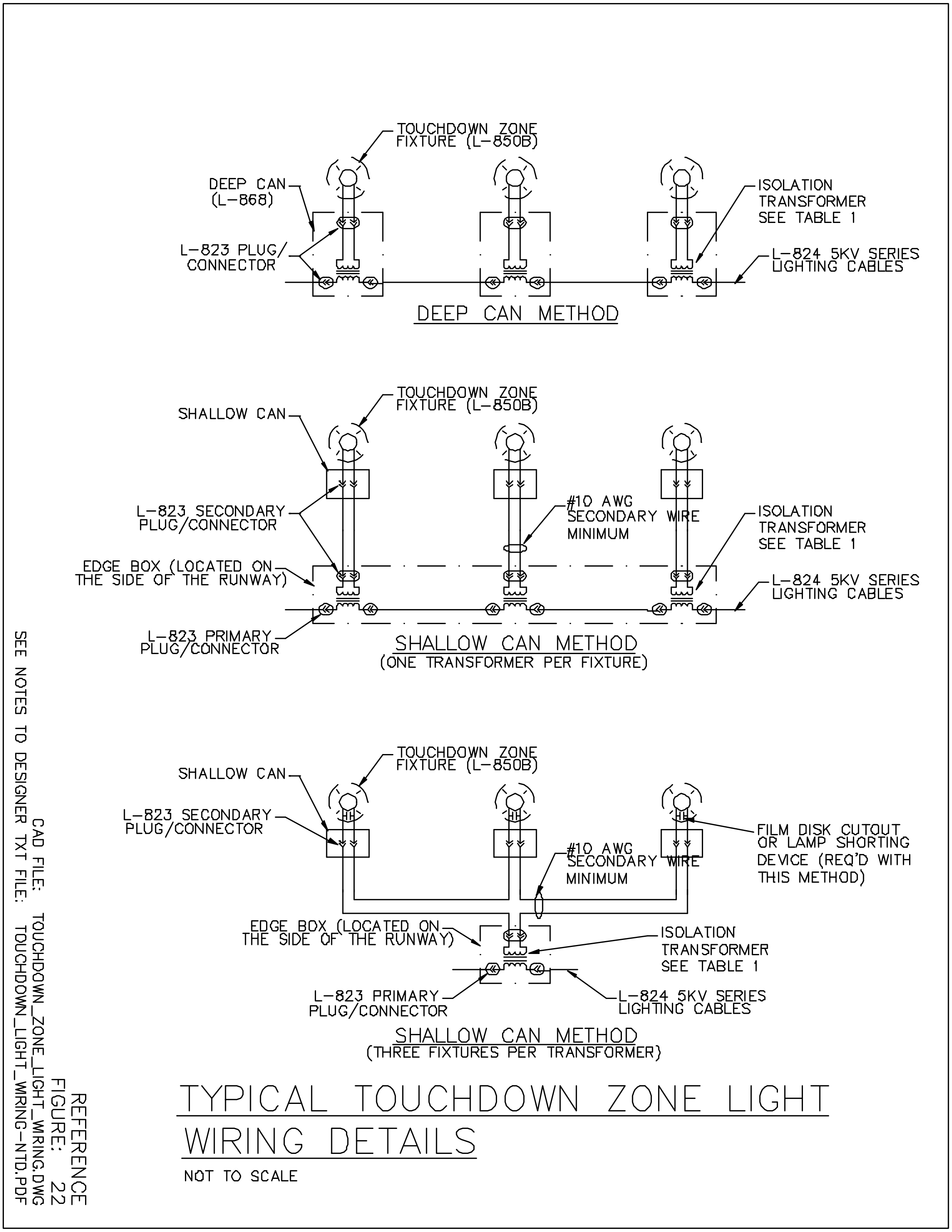


Figure 22. Typical Touchdown Zone Light Wiring Details

2.16. Touchdown Zone Lighting Wiring Diagram – Single Circuit

See figure 23.

Notes to Designer:

1. Refer to Volume I for circuiting considerations.

2. The monitoring requirements for Cat II and III runways require the number of lamps out to be monitored. The use of lamp shorting devices, either relay or film disk type, must be avoided for monitoring system to successfully detect lamps out. Fixtures connected with lamps in series won't be able to be monitored if shorting devices are employed.

3. Monitoring and control systems exist that utilize existing load cables to communicate via power line carrier technology. Individual lamp control and status monitoring can be achieved with these systems. System computers in vault can communicate control and load status signals to control tower or other remote locations.

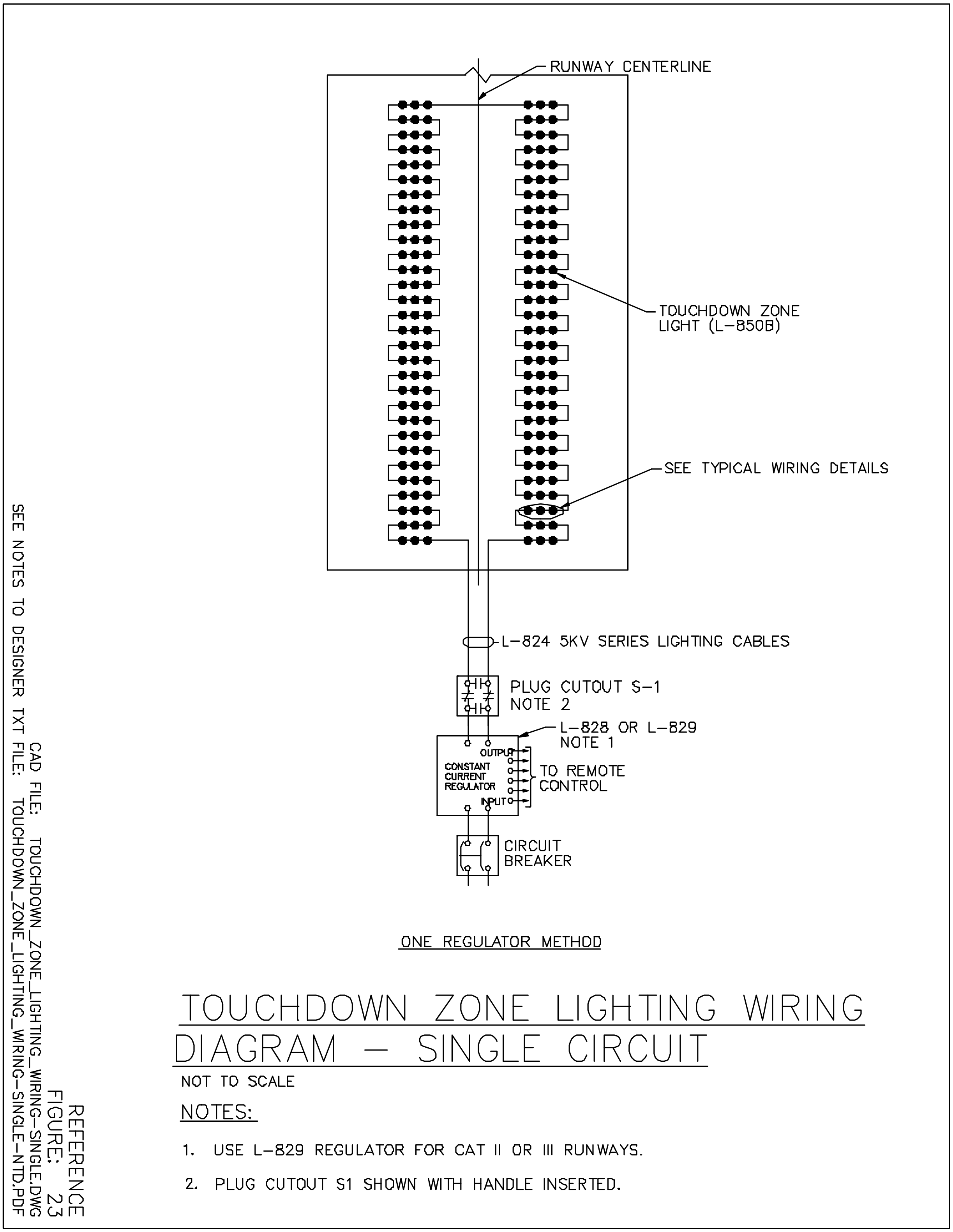


Figure 23. Touchdown Zone Lighting Wiring Diagram – Single Circuit

2.17. Typical Interleaved Touchdown Zone Lighting Wiring Diagram

See figure 24.

Notes to Designer:

1. Refer to Volume I for circuiting considerations.

2. The monitoring requirements for Cat II and III runways require the number of lamps out to be monitored. The use of lamp shorting devices, either relay or film disk type, must be avoided for monitoring system to successfully detect lamps out. Fixtures connected with lamps in series won't be able to be monitored if shorting devices are employed.

3. Monitoring and control systems exist that utilize existing load cables to communicate via power line carrier technology. Individual lamp control and status monitoring can be achieved with these systems. System computers in vault can communicate control and load status signals to control tower or other remote locations.

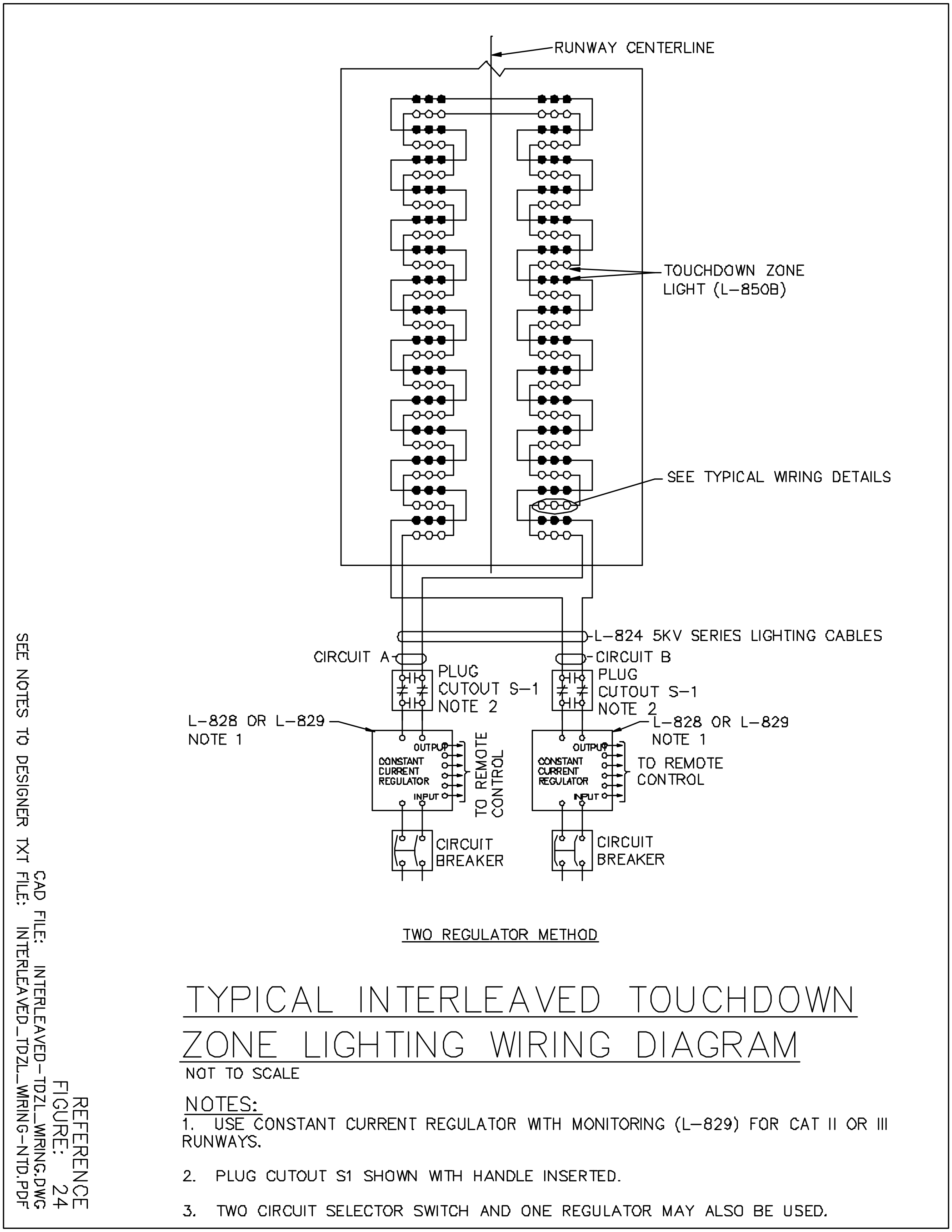


Figure 24. Typical Interleaved Touchdown Zone Lighting Wiring Diagram

2.18. Typical Interleaved Centerline Light Wiring Diagram

See figure 25.

Notes to Designer:

1. Refer to Volume I for circuiting considerations.

2. The monitoring requirements for Cat II and III runways require the number of lamps out to be monitored. The use of lamp shorting devices, either relay or film disk type, must be avoided for monitoring system to successfully detect lamps out. Fixtures connected with lamps in series won't be able to be monitored if shorting devices are employed.

3. Monitoring and control systems exist that utilize existing load cables to communicate via power line carrier technology. Individual lamp control and status monitoring can be achieved with these systems. System computers in vault can communicate control and load status signals to control tower or other remote locations

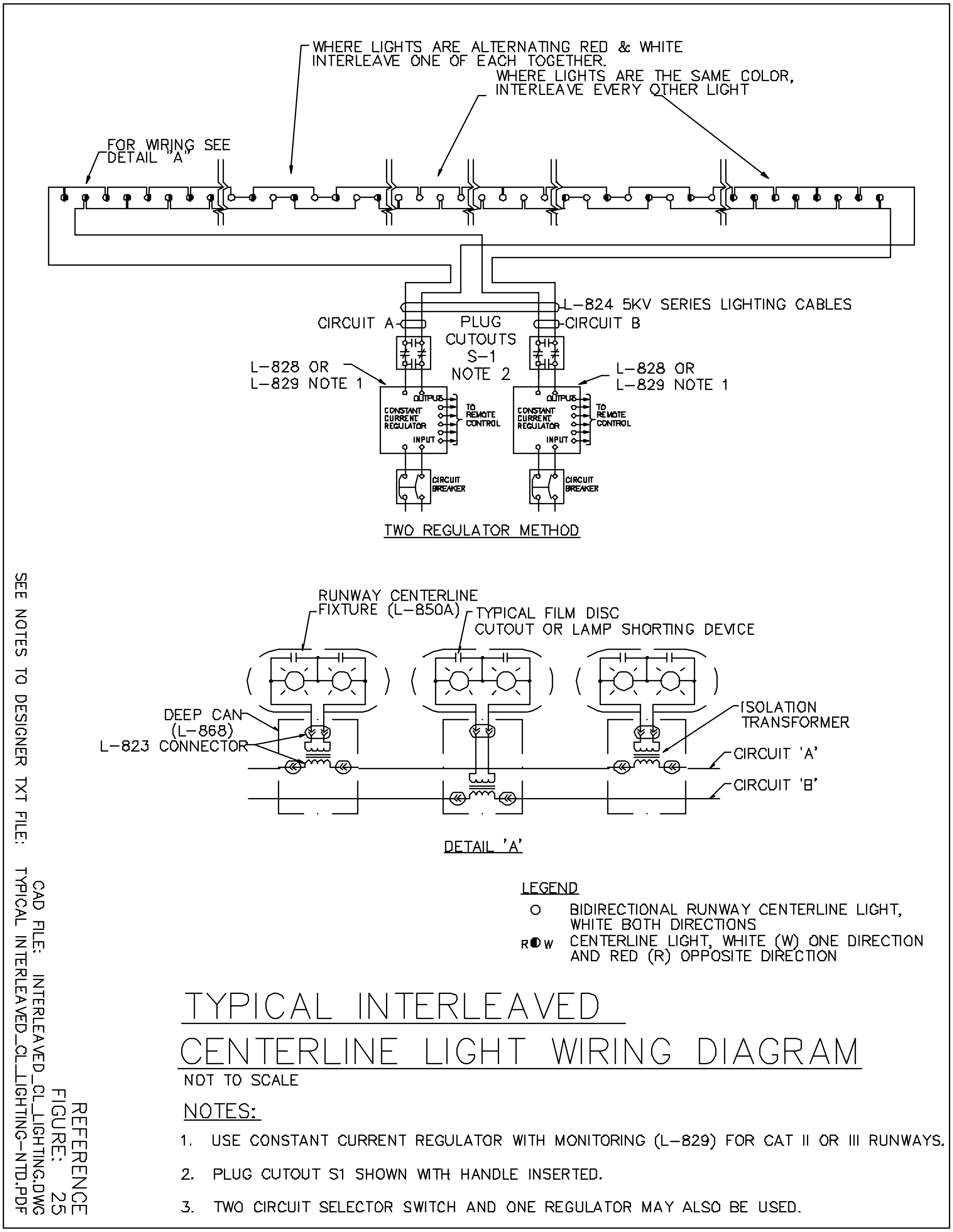


Figure 25. Typical Interleaved Centerline Light Wiring Diagram

2.19. Typical Interleaved Circuit Runway Lighting Wiring Diagram

See figure 26.

Notes to Designer:

1. This figure shows the interleaving method for circuiting the runway lighting system. Refer to Volume I for circuit design considerations.

2. This method is more expensive since the amount of cable is doubled, two regulators are required, and there are parallel controls.

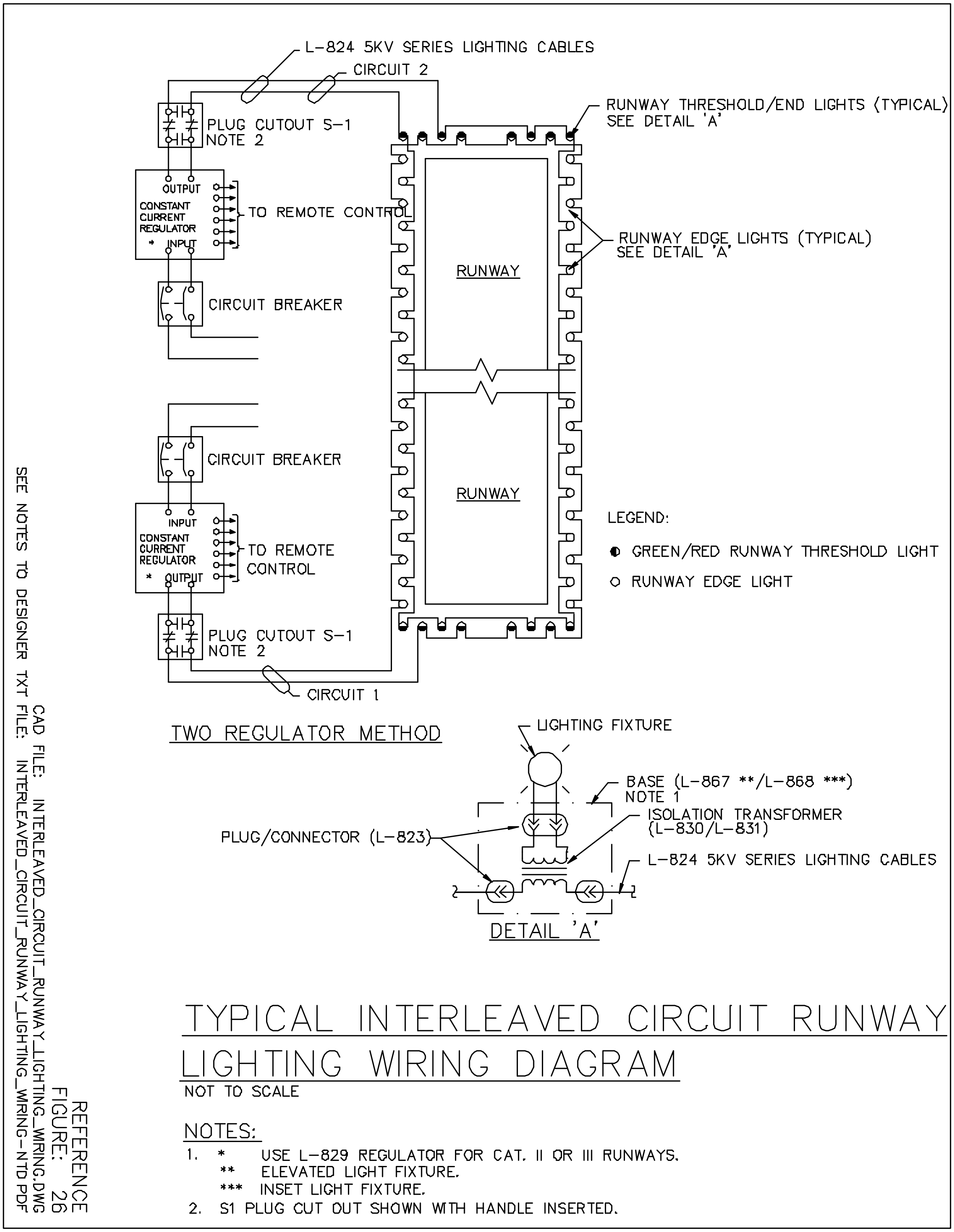


Figure 26. Typical Interleaved Circuit Runway Lighting Wiring Diagram

2.20. Typical Two Circuit/One Regulator Wiring Diagram

See figure 27.

Notes to Designer:

1. This method uses an L-847 selector switch and one regulator. The circuits are still interleaved so if there is an open in one of the circuits that circuit may be bypassed by turning off C1 and C2 (or vice versa) will still operate.

2. Circuit selector switches are available with up to 4 circuits and are useful during low visibility operations (SMGCS) where only designated taxi routes are used.

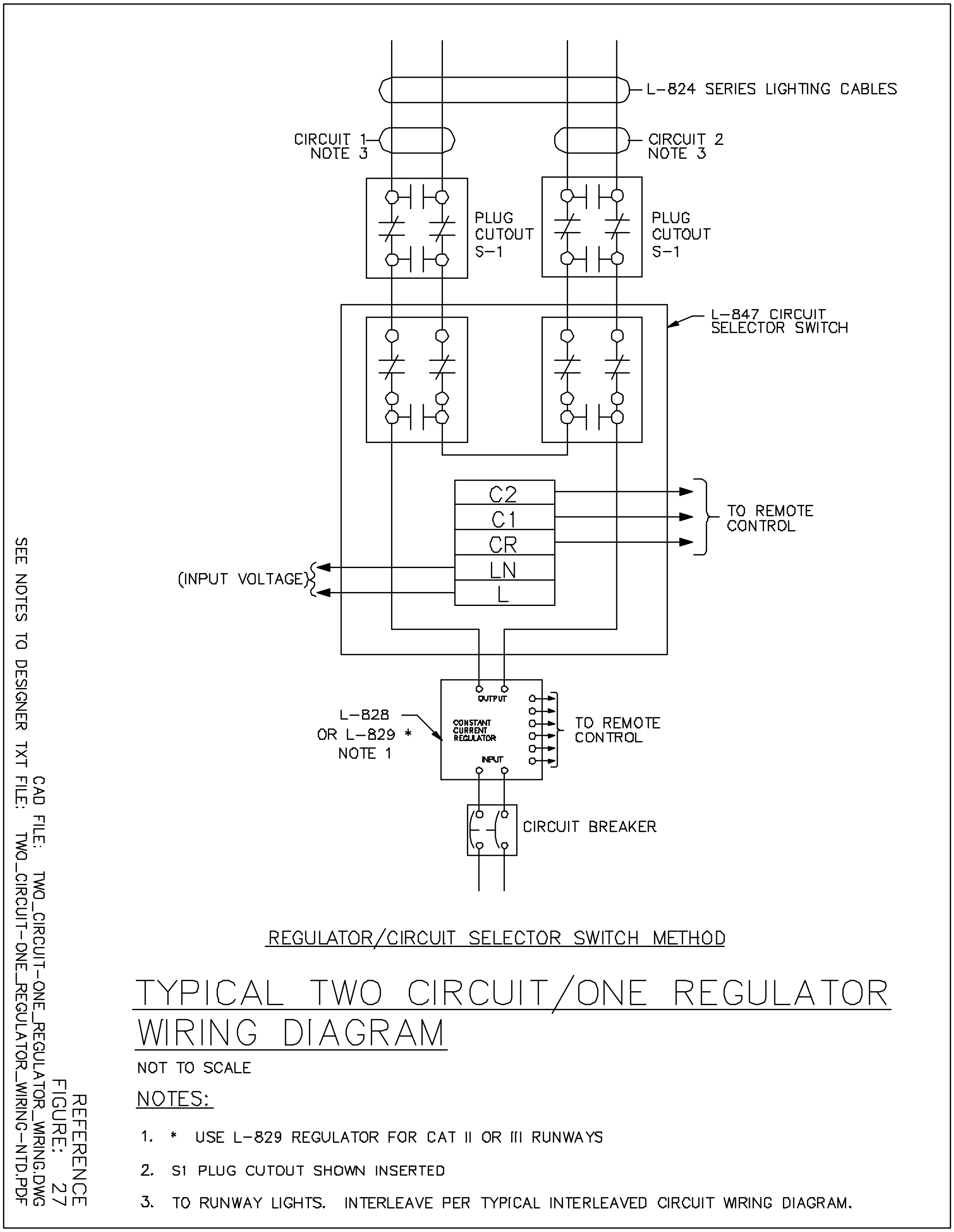


Figure 27. Typical Two Circuit/One Regulator Wiring Diagram

2.21. Radio Control of Constant Current Regulator Wiring Diagram

See figure 28.

Notes to Designer:

1. This diagram shows energizing the regulator by the use of an L-854 radio controller and interface device.

2. The serial outputs (#1, #2, #3) are energized one at a time by either 3, 5, or 7 clicks within a 5 second period on the pilot's radio. This provides a break before make contact arrangement.

3. The parallel outputs (#1, #2, #3) are energized sequentially (i.e., 1, 1+2, 1+2+3) by the same 3, 5, or 7 clicks of the pilot's radio. These outputs may be used to energize contactors feeding constant voltage equipment such as REILs or PAPIs.

4. Ensure regulator manufacturer is consulted prior to designing radio control system.

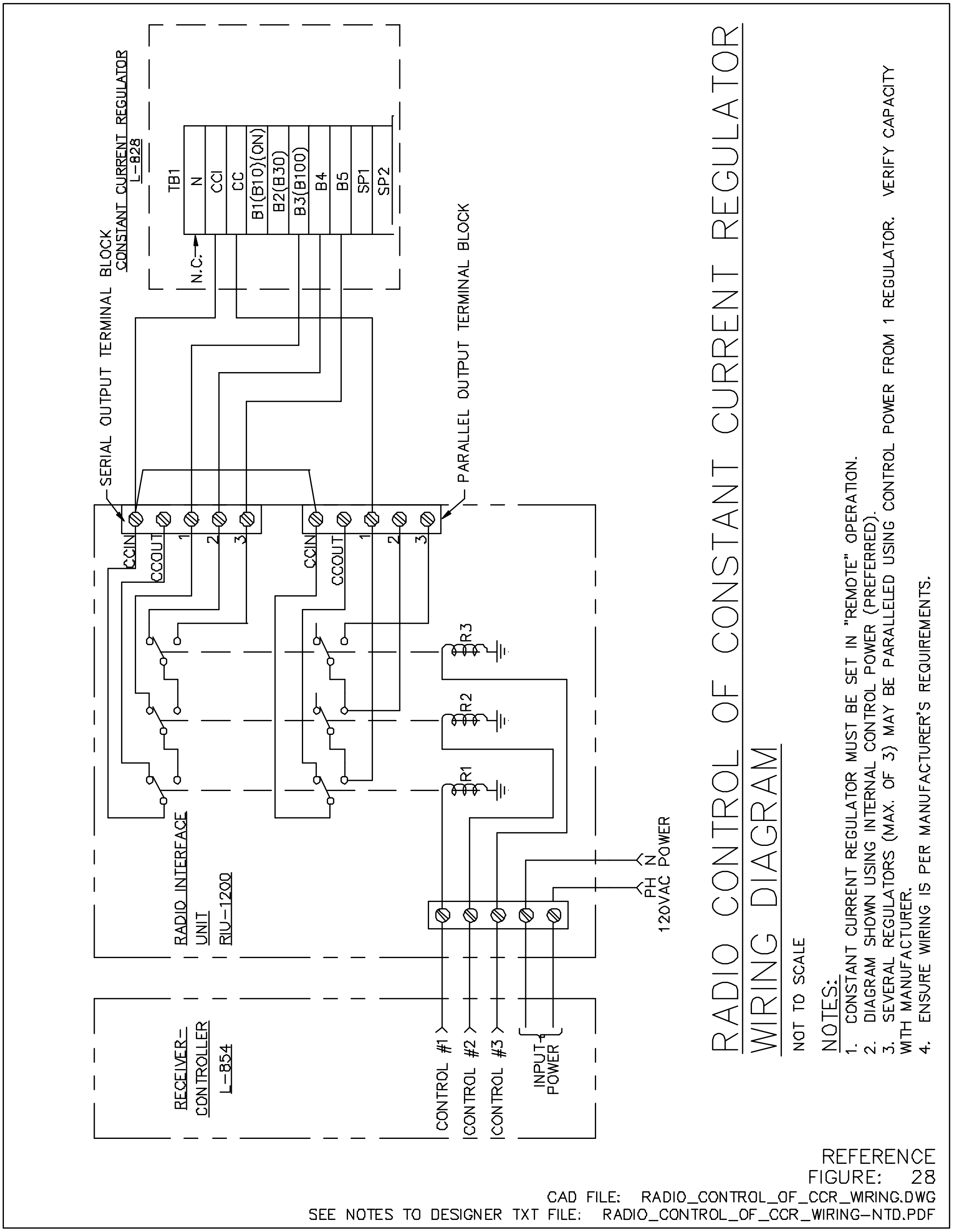


Figure 28. Radio Control of Constant Current Regulator Wiring Diagram

Chapter 3: AIRFIELD GUIDANCE SIGNS

3.1. Airfield Guidance Sign Detail

See figure 29.

Notes to Designer:

1. In addition to FAA AC 150/5340-18 and FAA AC 150/5345-44, the FAA has published a series of supplements known as SAMS (Signs and Marking Supplement). These supplements were established as a vehicle to provide answers to questions about signs and marking standards.

2. The L-867 handhole houses the sign's isolation transformer. It is typically mounted separately from the sign but within 610mm (2') from the sign's adjacent edge. This is done to allow access to the transformer without removing the sign. The following points should be noted about the installation of the power wiring to the sign:

   a. A secondary jumper cable must be provided which connects between the transformer's output cable and the sign's input cable. Even though the output cable on an isolation transformer is 1.22M (48") ± in length, do not connect this to the sign's input cable since it would defeat the purpose of mounting the isolation transformer separately.

   b. Several types of cable retaining clips (or cable clamps) are available and will depend on the type of mounting used for the sign's power leg (i.e. L-867 junction box or 2" conduit and floor flange) and the style of L-823 connector on the secondary jumper cable. The retaining clips hold the secondary jumper cable in place below the frangible coupling.

3. Recommend specifying, in the project contract documents, the maximum VA load allowed for each size of sign. This VA load should include the losses in the sign's isolation transformer. Refer to Volume I for typical VA loads of guidance signs.

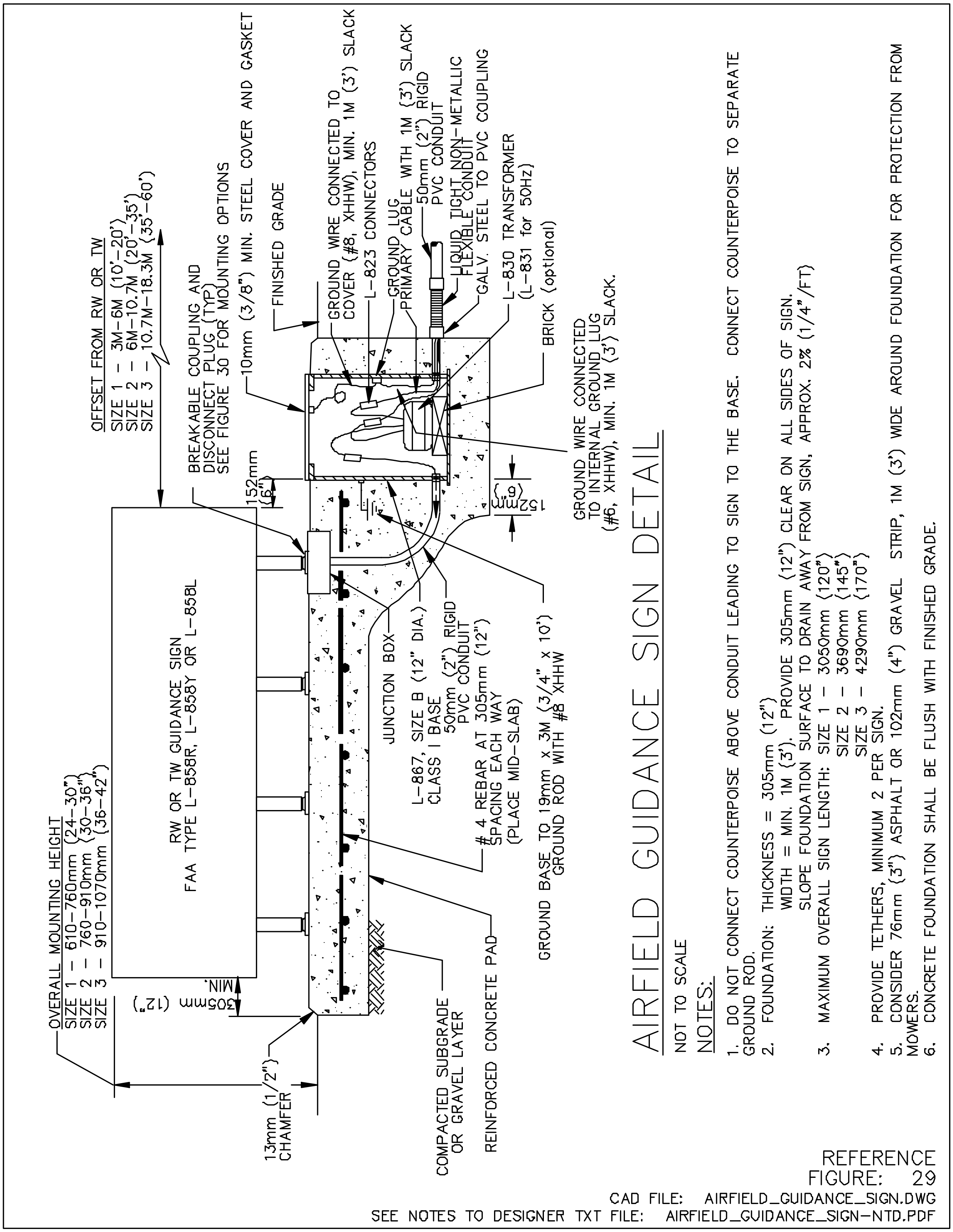


Figure 29. Airfield Guidance Sign Detail

3.2. Sign Base Power Leg Mounting Detail

See figure 30.

Notes to Designer:

1. The type of mounting for the power leg of the sign will usually be determined by the sign manufacturer. These details show different options that could be used. Whichever one is used, it is recommended that details shown on contract documents state that installation shall be per manufacturer's requirements.

2. Use flexible conduit between the sign base and the L-867 handhole when the handhole is not a part of the sign base. This will allow for movement between the base and handhole during possible freeze/thaw cycles in cold climates.

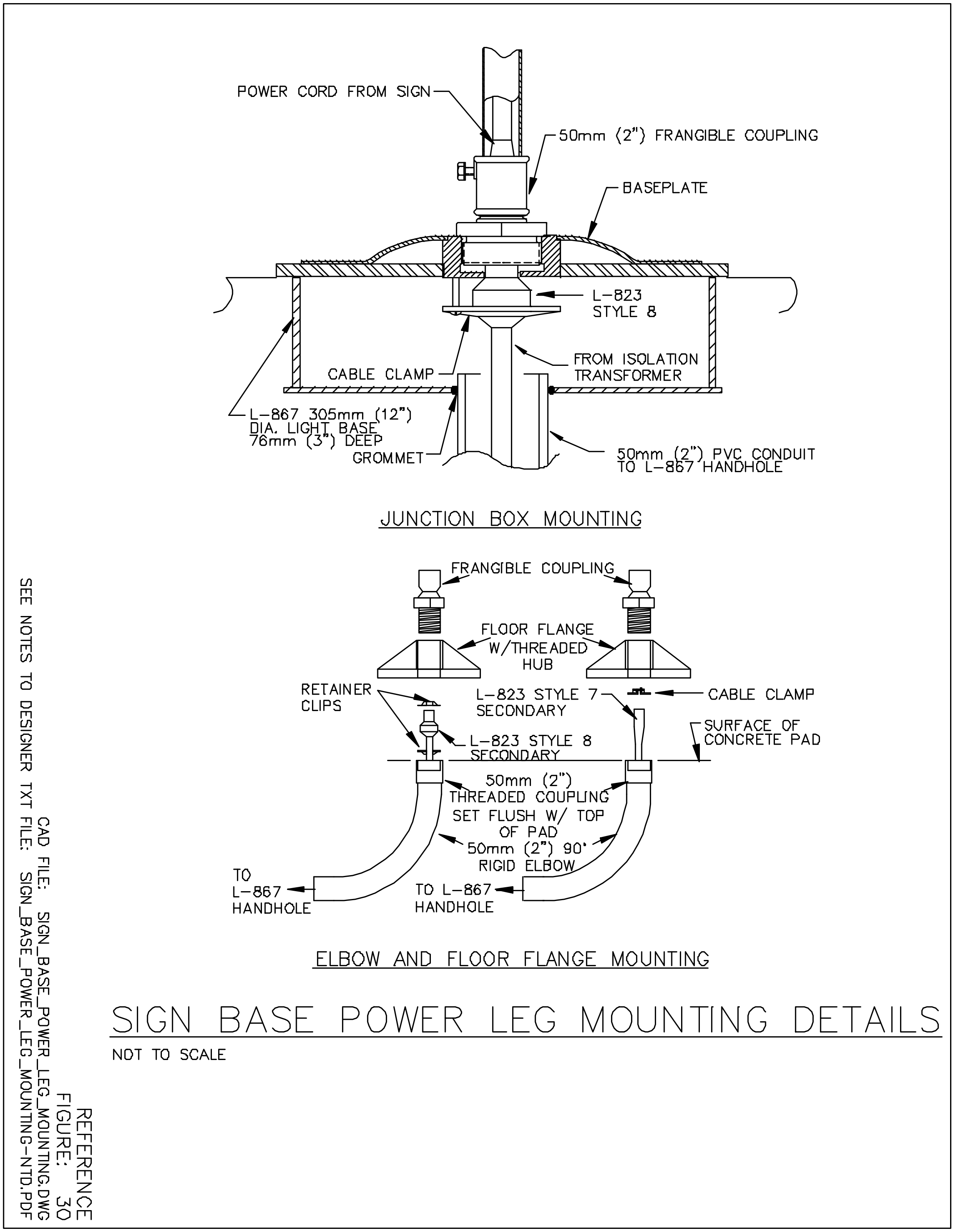


Figure 30. Sign Base Power Leg Mounting Detail

Chapter 4: APPROACH LIGHTING SYSTEMS

4.1. L-867 Size D Handhole

See figure 31.

Notes to Designer:

1. The handhole is utilized at each sequenced flasher station and tower mounted approach light station. It acts as a cable pulling handhole and houses the isolation transformers in an ALSF, SSALR, MALSR, or SALS approach light system.

2. The flexible conduit allows for movement during freeze/thaw cycles in cold climates thereby reducing the possibility of shearing the conduits.

3. The 51mm (2”) conduit between handholes is a minimum. The actual dimension depends on the number of cables being routed. A #8, L-824C, 5kv conductor is equivalent in diameter to #2 THWN and a #6, L-824C, 5kv is equivalent in diameter to a #1 THWN. 51mm (2”) hubs are standard on an L-867 base and other sizes are optional. Ensure contract documents specify hub size.

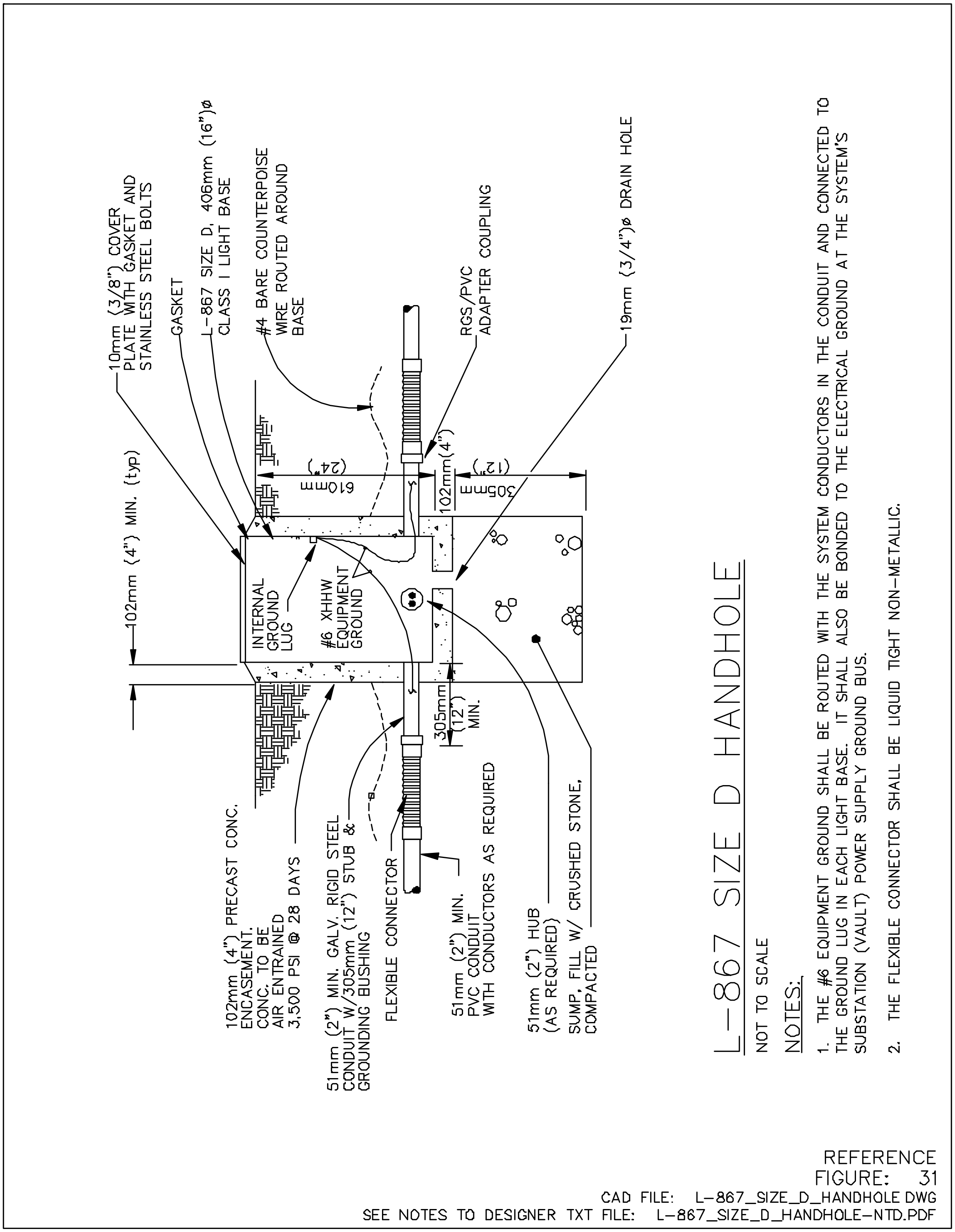


Figure 31. L-867 Size D Handhole

4.2. Sequenced Flasher Power Supply and Junction Box Mounting Detail

See figure 32.

Notes to Designer:

1. Each sequenced flasher requires its own power supply (individual control cabinet) and junction box. These are normally mounted as close to the flash head as possible. The standard manufacturer furnished cable between the flash head and the power supply is 18.3M (60’) maximum. The interconnecting wiring between the flasher junction box and the power supply is furnished by the contractor. If the flasher is mounted on a structure that is above 12.2M (40’), then the power supply is mounted up on the maintenance platform and the junction box is mounted at the base of the tower.

2. The flexible conduit allows for shifting due to freeze/thaw cycles in cold climates.

3. Recommend becoming familiar installation requirements from several different manufacturers.

4. The connection between the junction box and power supply is shown below grade by a 51mm (2”) conduit. Some manufacturers connect the two directly with a short section of 51mm (2”) conduit.

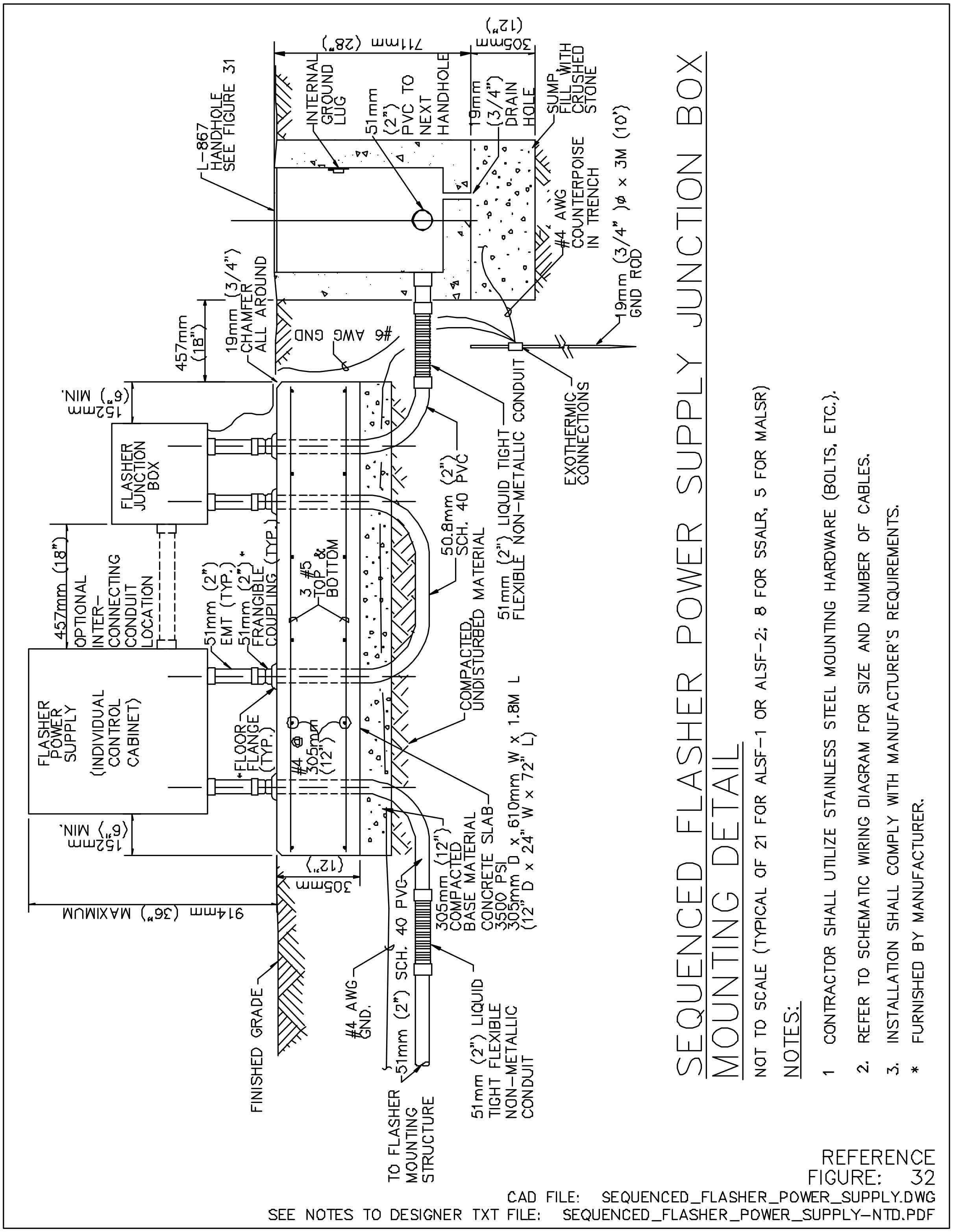


Figure 32. Sequenced Flasher Power Supply and Junction Box Mounting Detail

4.3. Typical MG-20 L.I.R. Structure 1854mm (6’-1”) to 6.43M (21’-1”)

See figure 33.

Notes to Designer:

1. The contract documents should include an approach lighting profile plan that will state by station # the height above grade.

2. Refer to Chapter 3 in Volume I of the manual for the spacing and number of the lights on the T-bar assembly. Specify the appropriate spacing (for the system being installed) in this detail and modify the detail to show the appropriate number of lights.

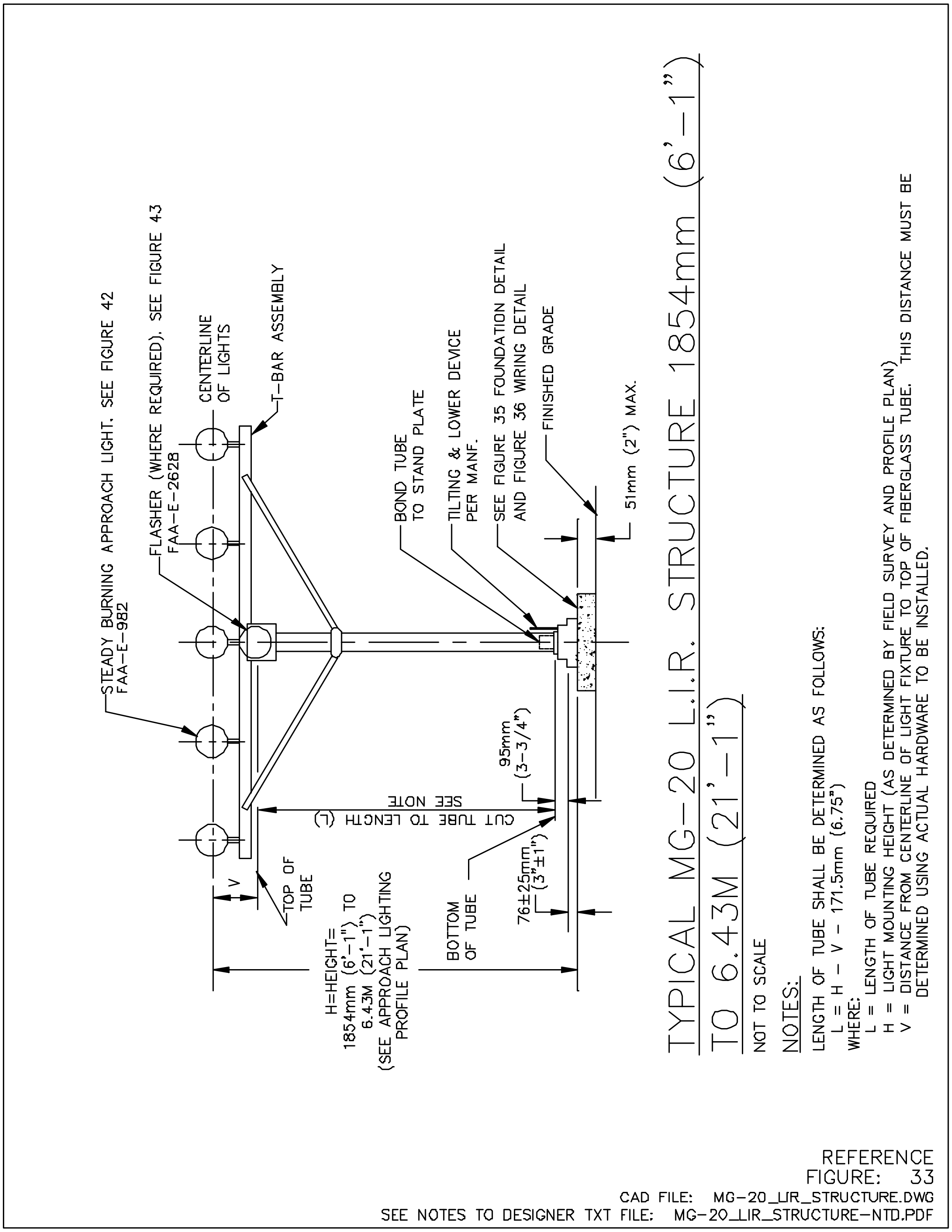


Figure 33. Typical MG-20 L.I.R. Structure 1854mm (6'-1") to 6.43M (21'-1")

4.4. Foundation for L.I.R. Structure MG-20 Plan View

See figure 34.

Notes to Designer:

1. The female couplings are for mounting the 51mm (2”) frangible couplings and condulet for wiring to the tower. Two are required (one on each side) if both a sequenced flasher and steady burn lights are co-located on a tower.

2. Foundation shown is as recommended by tower manufacturer. However, rectangular foundations have been used in some installations. Consult with tower manufacturer for different options based on soil conditions, bearing capacity, etc.

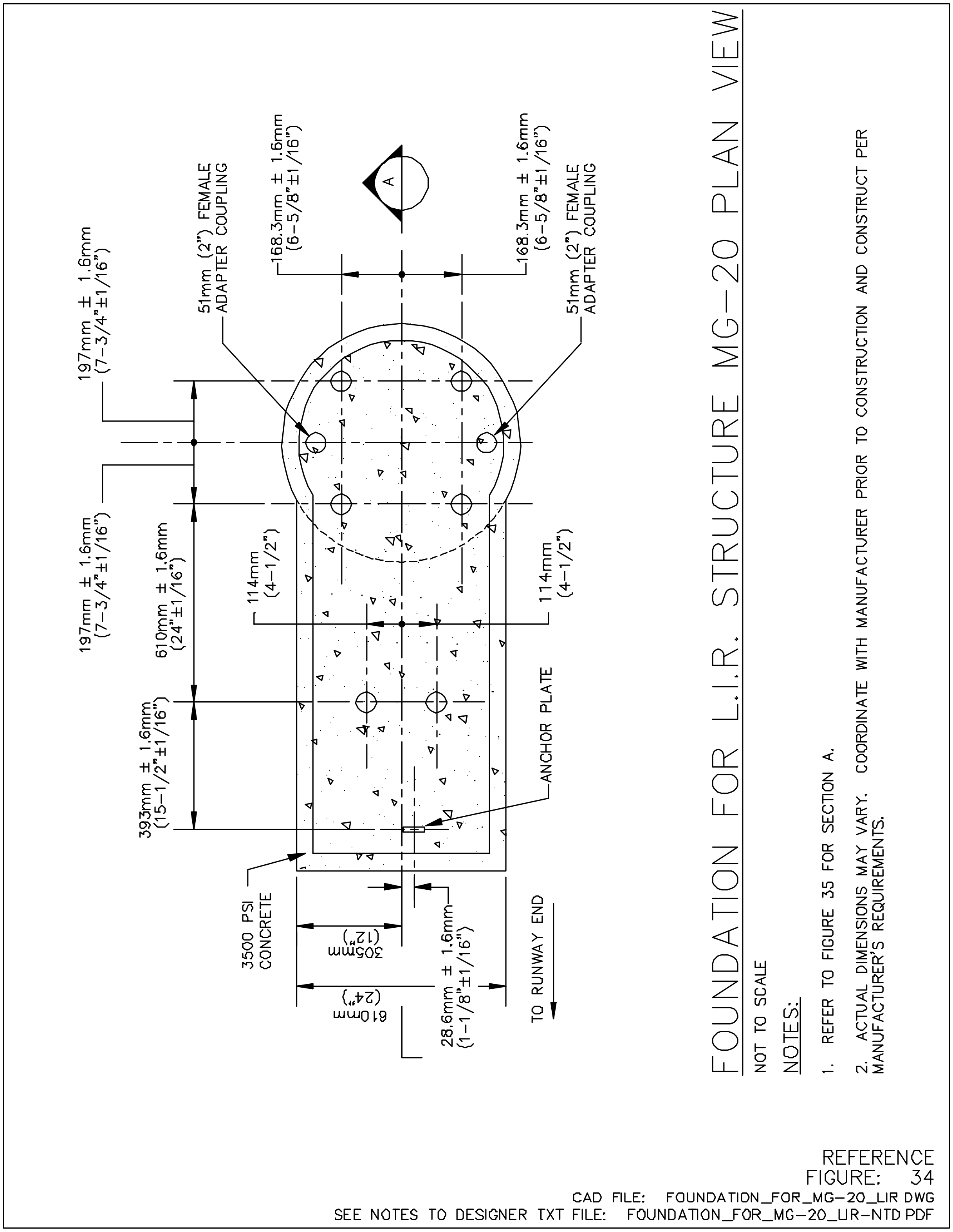


Figure 34. Foundation for L.I.R. Structure MG-20 Plan View

4.5. Foundation for L.I.R. Structure MG-20 Sections A & B

See figure 35.

Notes to Designer:

1. The foundation shown is a suggested foundation by the tower manufacturer (Jaquith Industries Inc.). The diameter was increased to allow the installation of the conduits in the foundation and still allow clearance for the tilt base on the tower.

2. Prior to designing the foundation for the tower, borings should be taken in the field for soil analysis. Many factors will affect the type and size of foundation to be installed (i.e. type of soil, existence of rock or ledge, soil bearing capacity, frost depth, etc.). The designer should base the foundation design on these factors and consult with the tower manufacturer regarding EPA (Effective Projected Area) for wind loading. The wind loading shall include the proposed fixtures and hardware to be installed on the tower.

3. In areas that are susceptible to frost, a rectangular foundation is recommended. The foundation should include a spread footing to resist uplift. The foundation should also be continuous from grade down to the footing with necessary rebar and eliminate the cantilevered portion, as shown in the detail.

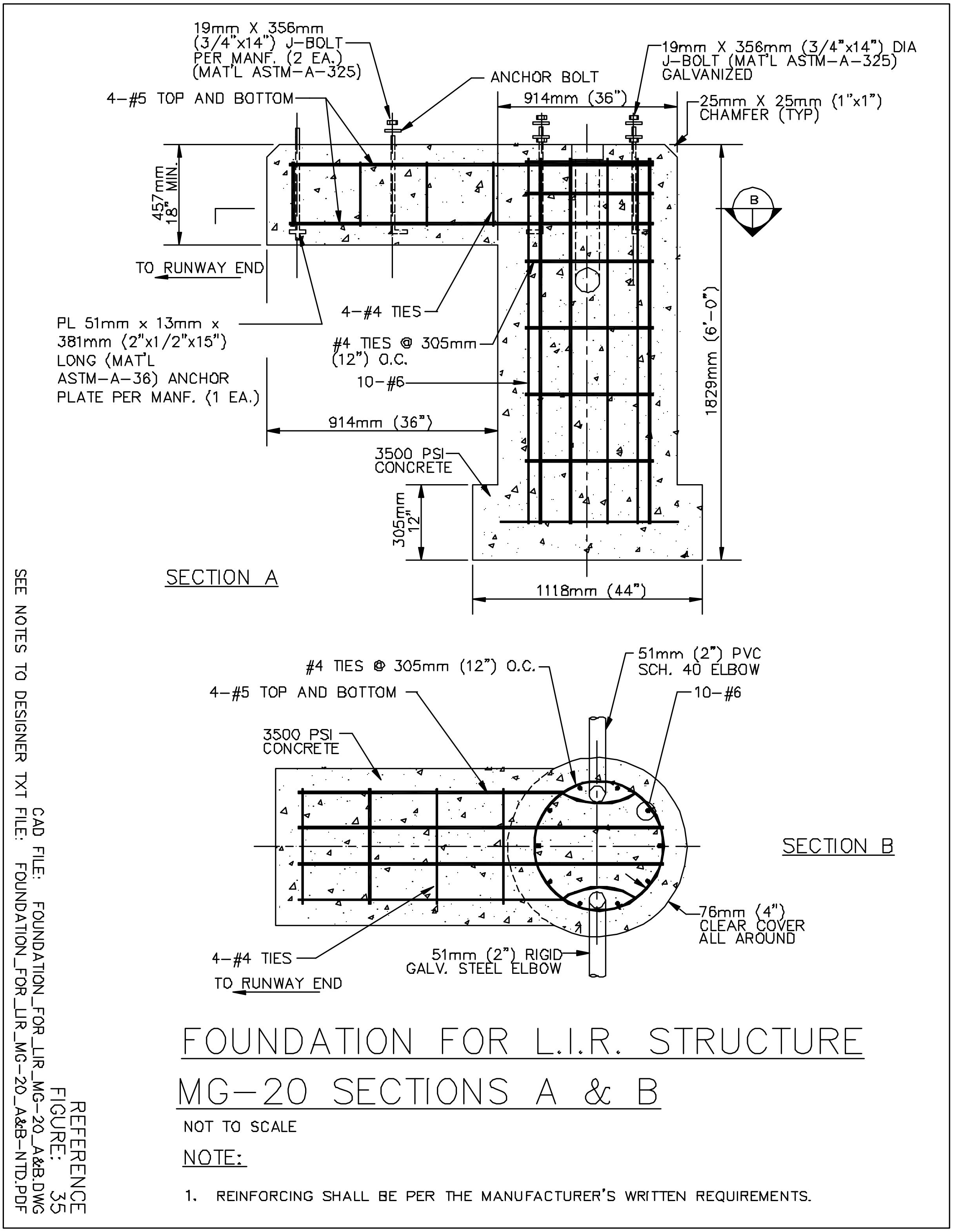


Figure 35. Foundation for L.I.R. Structure MG-20 Sections A & B

4.6. Typical MG-20 L.I.R. Structure Tower Wiring Detail

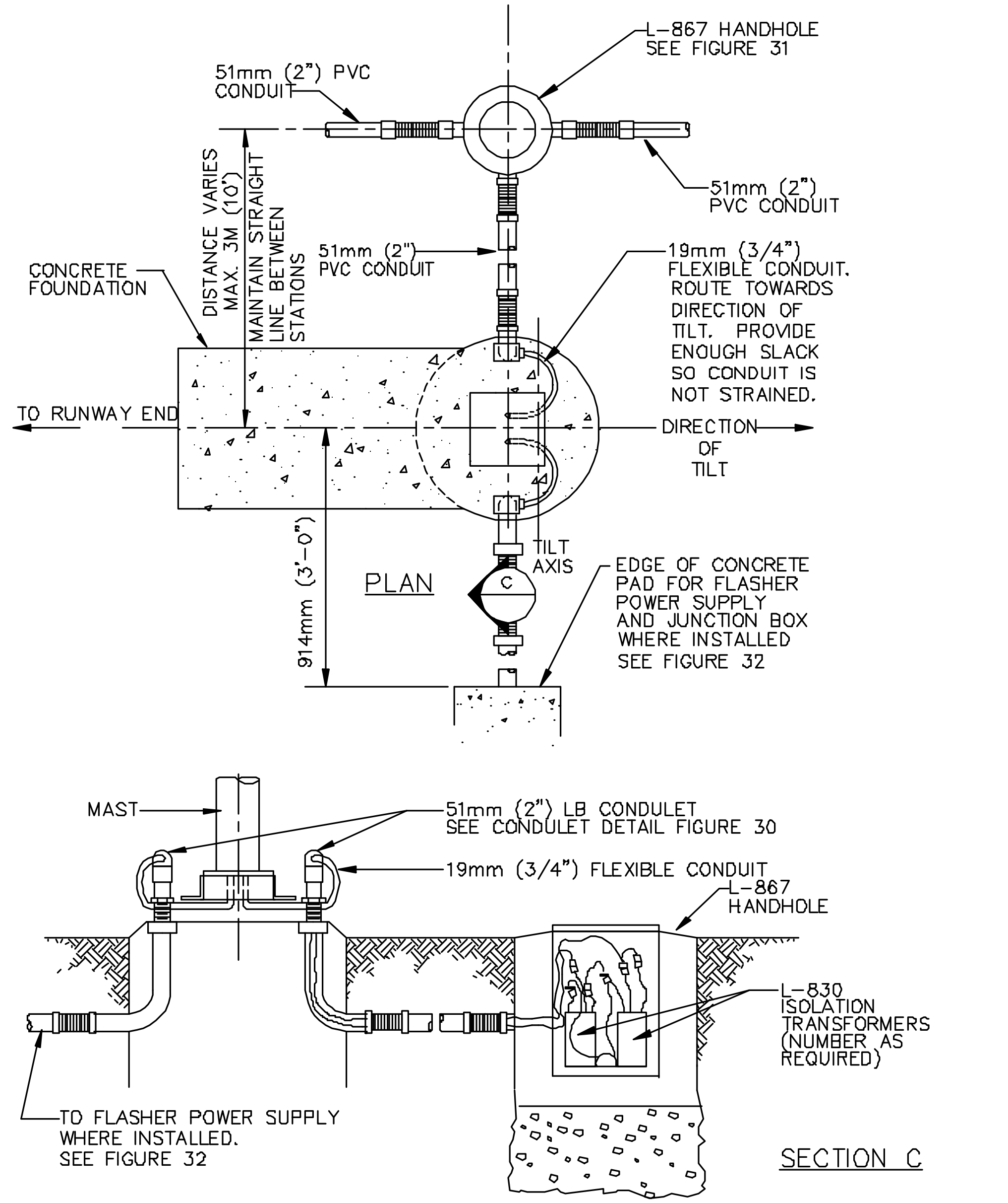
See figure 36.

Notes to Designer:

1. Location of the handhole with respect to the tower foundation will depend on system layout. Recommend keeping same distance from each tower foundation throughout system thereby allowing a straight run between handholes.

2. The tower tilts away from the end of runway and towards the approach. Routing the conduit towards the direction of the tilt and maintaining slack will prevent putting strain on the conduit while the tower is raised and lowered.

3. The number of isolation transformers will depend on the wattage and number of lamps to be installed. If more than one lamp is installed per isolation transformer, then the steady burn approach light must be specified with a lamp shorting device so the other lamps will remain on if one lamp burns out.



TYPICAL MG-20 L.I.R. STRUCTURE TOWER WIRING DETAIL

NOT TO SCALE

NOTE:

NUMBER OF CONDUCTORS WILL VARY DEPENDING ON NUMBER OF ISOLATION TRANSFORMERS USED, REQUIREMENTS OF SEQUENCED FLASHERS, ETC. VERIFY REQUIREMENTS WITH SYSTEM WIRING DIAGRAMS AND PROVIDE (FURNISH AND INSTALL) NECESSARY CONDUCTORS.

REFERENCE
FIGURE: 36
CAD FILE: MG-20_LIR_TOWER.DWG
SEE NOTES TO DESIGNER TXT FILE: MG-20_LIR_TOWER-NTD.PDF

Figure 36. Typical MG-20 L.I.R. Structure Tower Wiring Detail

4.7. 51mm (2”) LB Conduit Detail

See figure 37.

Notes to Designer:

Figure is self-explanatory.

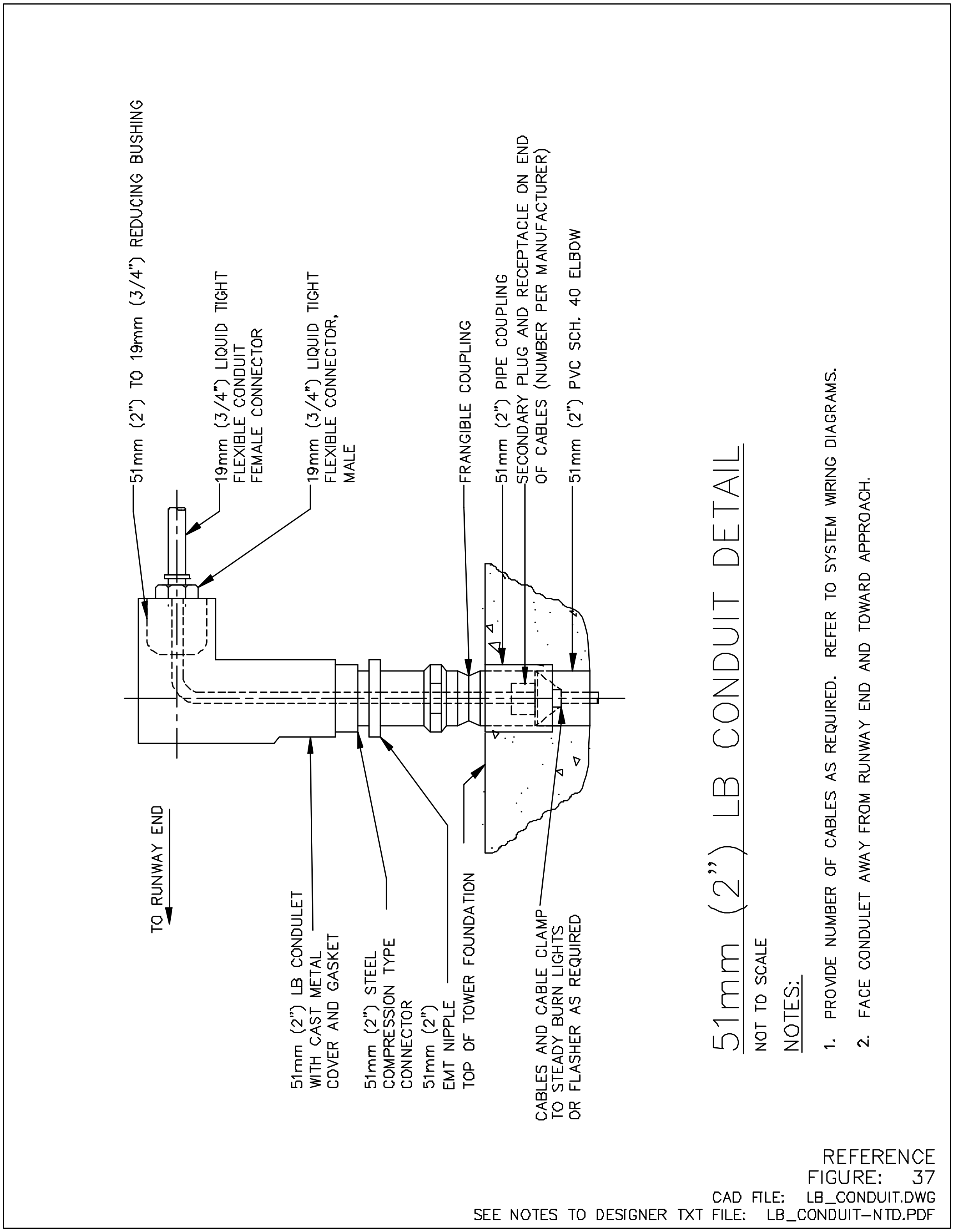


Figure 37. 51mm (2") LB Conduit Detail

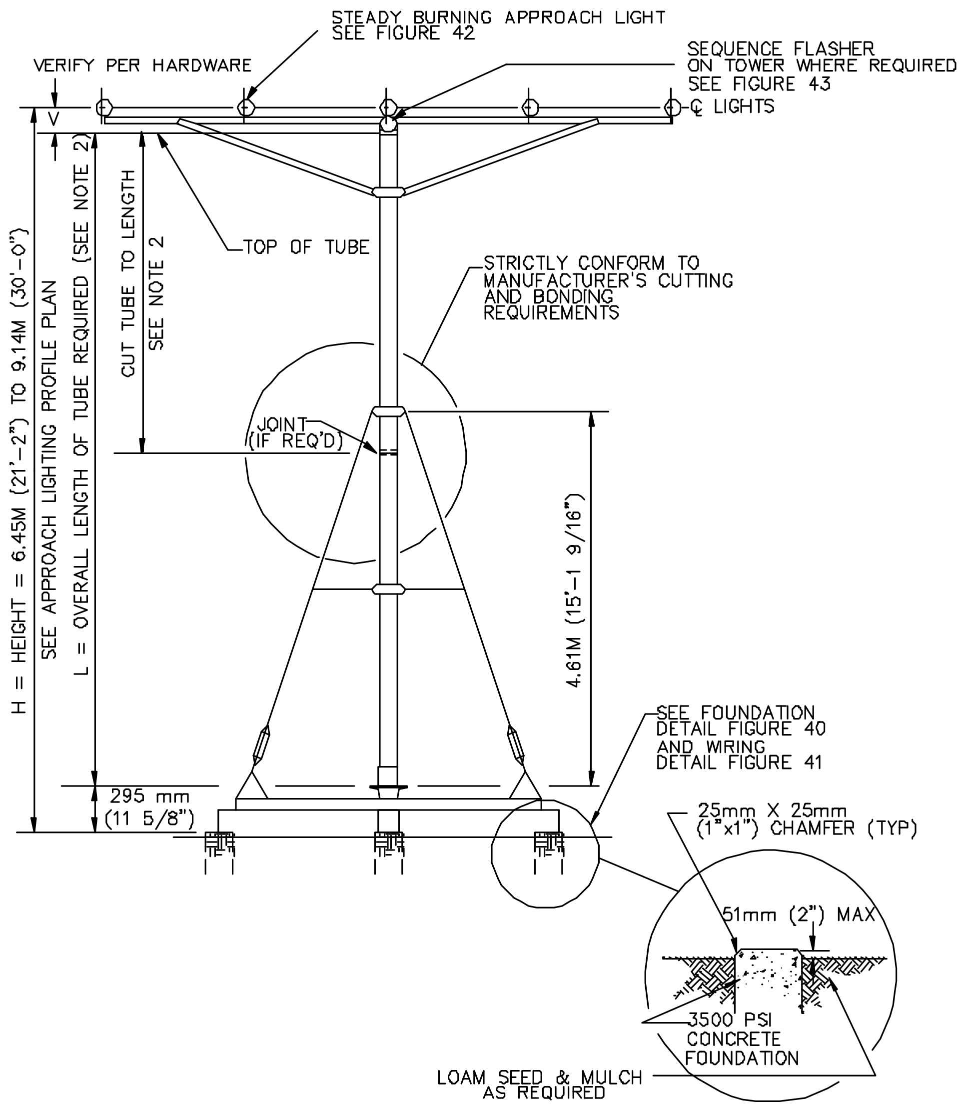
4.8. Typical MG-30 L.I.R. Structure 6.45M (21'-2") to 9.14M (30'-0")

See figure 38.

Notes to Designer:

1. The contract documents should include an approach lighting profile plan that will state by station # the height above grade.

2. Refer to Chapter 3 in Volume I of the manual for spacing and number of lights on the T-bar assembly. Specify the appropriate spacing (for the system being installed) in this detail and modify the detail to show the appropriate number of lights.



TYPICAL MG-30 L.I.R. STRUCTURE
6.45M (21'-2") TO 9.14M (30'-0")

NOT TO SCALE

NOTES:

1. FOUNDATIONS, CONNECTIONS, STABILIZERS, TILT DEVICES AND ASSOCIATED COMPONENTS SHALL BE PER MANUFACTURER'S WRITTEN SPECIFICATIONS.

2. LENGTH OF TUBE SHALL BE DETERMINED AS FOLLOWS: L = H − V − 6.38M (20' + 11 5/8")
WHERE L = OVERALL LENGTH OF TUBE REQUIRED
H = LIGHT MOUNTING HEIGHT (AS DETERMINED BY FIELD SURVEY AND PROFILE PLAN)
V = DISTANCE FROM CENTERLINE OF FIXTURE TO TOP OF FIBERGLASS TUBE. THIS DISTANCE MUST BE DETERMINED USING ACTUAL HARDWARE TO BE INSTALLED.

REFERENCE
FIGURE: 38
CAD FILE: MG-30_LIR.DWG
SEE NOTES TO DESIGNER TXT FILE: MG-30_LIR-NTD.PDF

Figure 38. Typical MG-30 L.I.R. Structure 6.45M (21'-2") to 9.14M (30'-0")

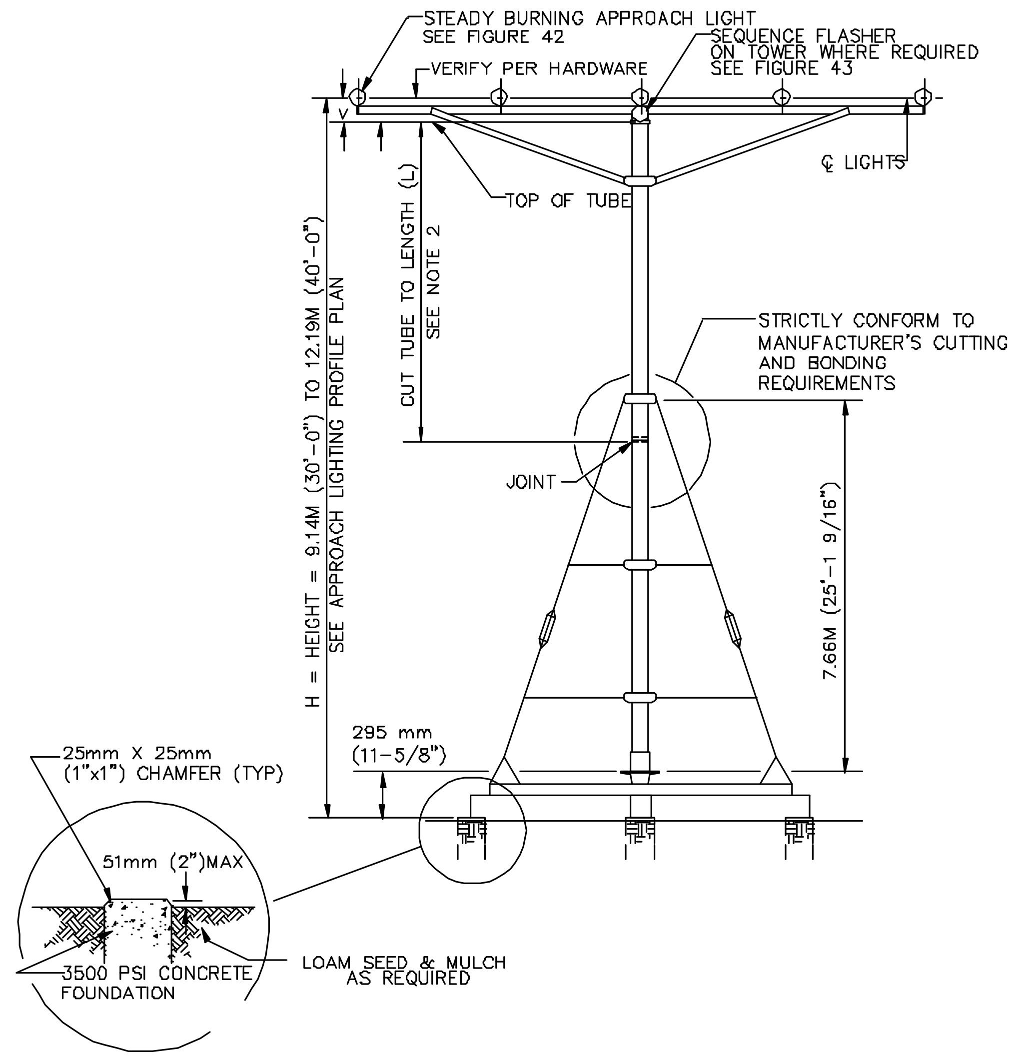
4.9. Typical MG-40 L.I.R. Structure 9.14M (30'-0") to 12.19M (40'-0")

See figure 39.

Notes to Designer:

1. The contract documents should include an approach lighting profile plan that will state by station # the height above grade.

2. Refer to Chapter 3 in Volume I of the manual for spacing and number of lights on the T-bar assembly. Specify the appropriate spacing (for the system being installed) in this detail and modify the detail to show the appropriate number of lights.



TYPICAL MG-40 L.I.R. STRUCTURE
9.14M (30'-0") TO 12.19M (40'-0")

NOT TO SCALE

NOTES:

1. FOUNDATIONS, CONNECTIONS, STABILIZERS, TILT DEVICES AND ASSOCIATED COMPONENTS SHALL BE PER MANUFACTURER'S WRITTEN SPECIFICATIONS.

2. LENGTH OF TUBE SHALL BE DETERMINED AS FOLLOWS: L = H – V – 6.38M (20' + 11-5/8")
WHERE L = OVERALL LENGTH OF TUBE REQUIRED
H = LIGHT MOUNTING HEIGHT (AS DETERMINED BY FIELD SURVEY AND PROFILE PLAN)
V = DISTANCE FROM CENTERLINE OF FIXTURE TO TOP OF FIBERGLASS TUBE. THIS DISTANCE MUST BE DETERMINED USING ACTUAL HARDWARE TO BE INSTALLED.

REFERENCE
FIGURE: 39
CAD FILE: MG-40_LIR.DWG
SEE NOTES TO DESIGNER TXT FILE: MG-40_LIR-NTD.PDF

Figure 39. Typical MG-40 L.I.R. Structure 9.14M (30'-0") to 12.19M (40'-0")

4.10. Foundation for MG-30/40 L.I.R. Structures

See figure 40.

Notes to Designer:

1. The foundation shown is a suggested foundation by the tower manufacturer (Jaquith Industries Inc.). The diameter was increased to allow the installation of the conduits in the foundation and still allow clearance for the tilt base on the tower.

2. Prior to designing the foundation for the tower, borings should be taken in the field for soil analysis. Many factors will affect the type and size of foundation to be installed (i.e. type of soil, existence of rock or ledge, soil bearing capacity, frost depth, etc.). The designer should base the foundation design on these factors and consult with the tower manufacturer regarding EPA (Effective Projected Area) for wind loading. The wind loading shall include the proposed fixtures and hardware to be installed on the tower.

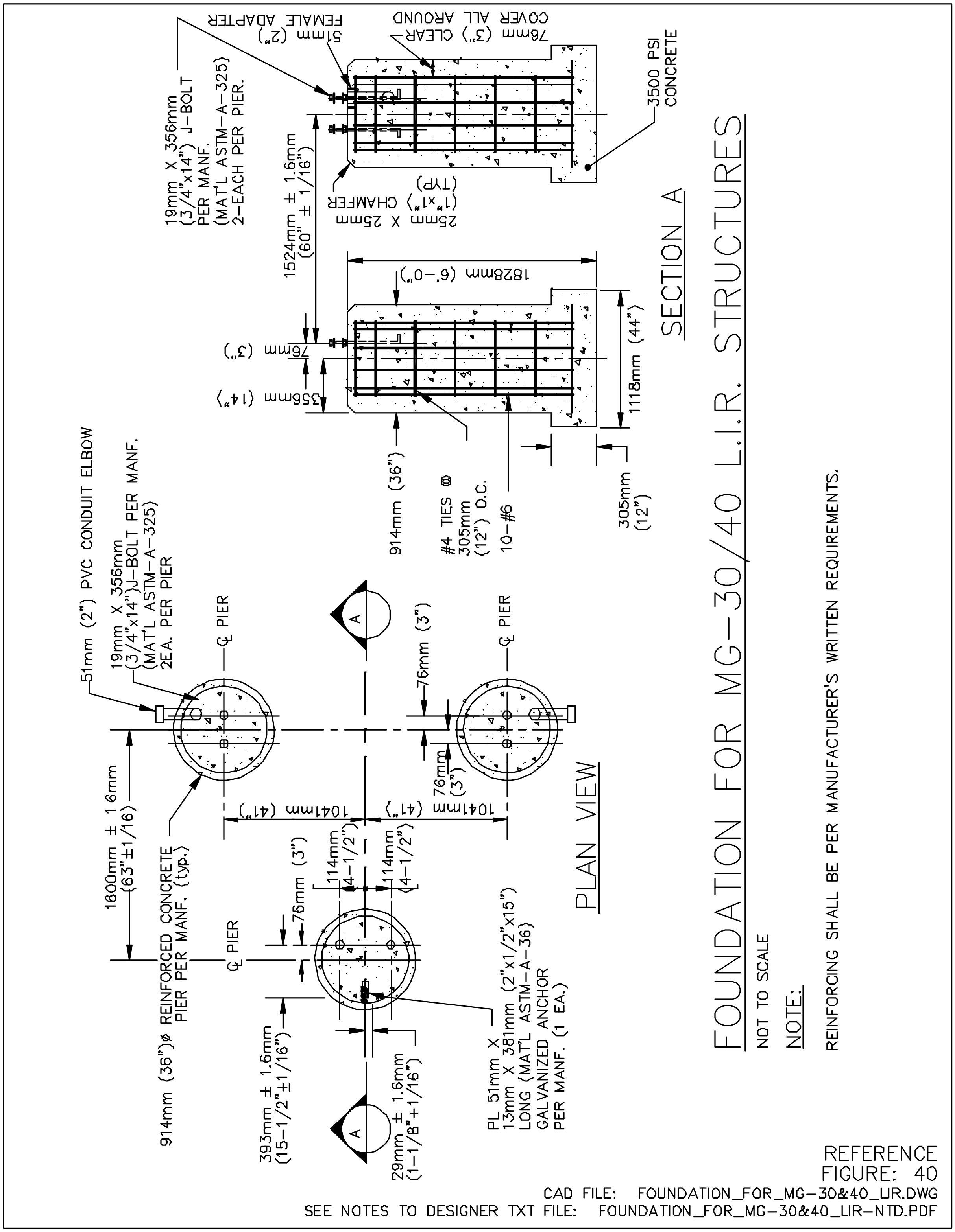


Figure 40. Foundation for MG-30/40 L.I.R. Structures

4.11. Typical MG-30/40 L.I.R. Structure Tower Wiring Detail

See figure 41.

Notes to Designer:

1. Location of the handhole with respect to the tower foundation will depend on system layout. Recommend keeping same distance from each tower foundation throughout system thereby allowing a straight run between handholes.

2. The tower tilts away from the end of runway and towards the approach. Routing the conduit towards the direction of the tilt and maintaining slack will prevent putting strain on the conduit while the tower is raised and lowered.

3. The number of isolation transformers will depend on the wattage and number of lamps to be installed. If more than one lamp is installed per isolation transformer, then the steady burn approach light must be specified with a lamp shorting device so the other lamps will remain on if one lamp burns out.

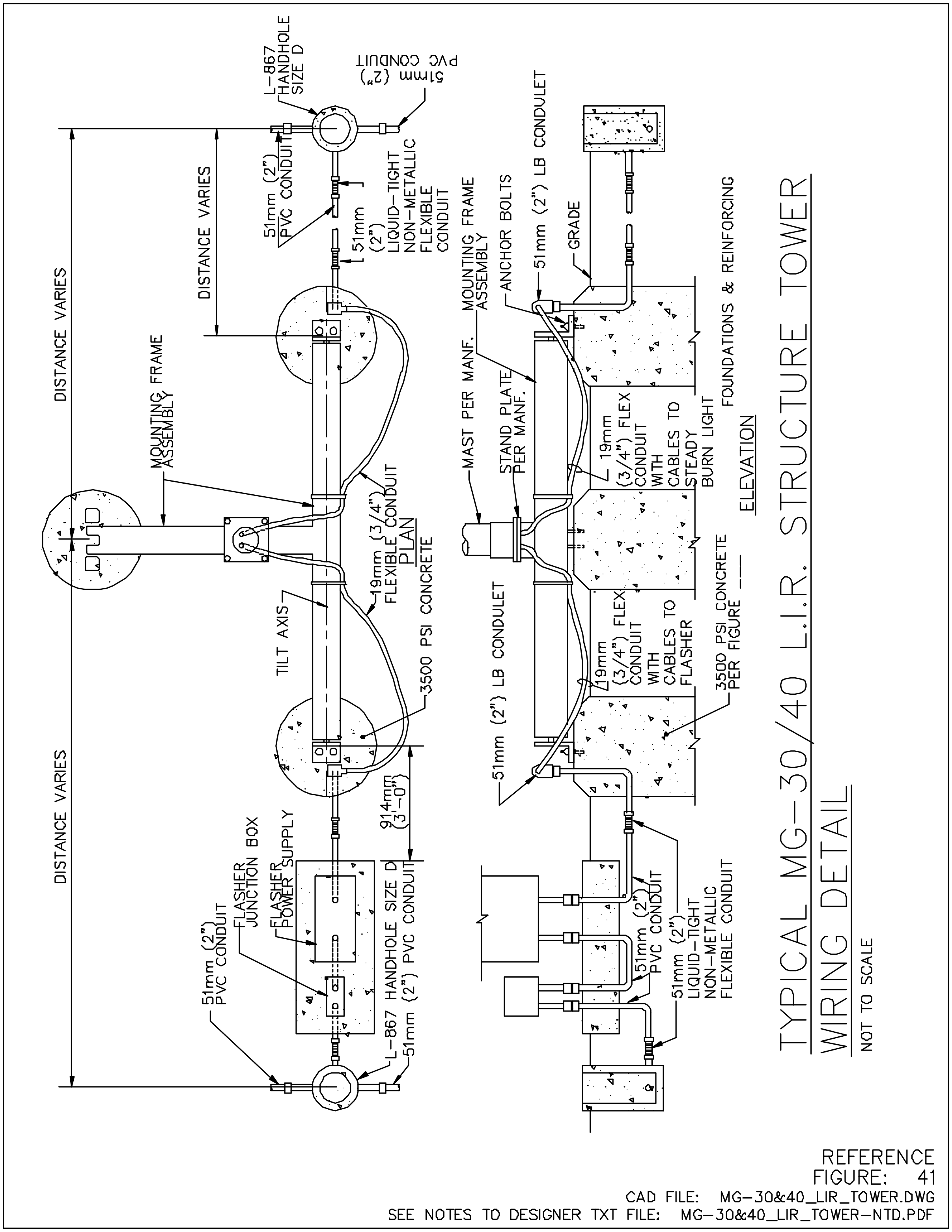


Figure 41. Typical MG-30/40 L.I.R. Structure Tower Wiring Detail

4.12. Tower Mounted Approach Light Detail

See figure 42.

Notes to Designer:

1. The FAA does not require a grounding terminal in the lamp holder. However, more recent installations have installed an equipment ground to the lamp holder. The ground conductor is routed with the circuit conductors and is bonded to the steel base plate and mounting assembly. This in turn is bonded to a ground.

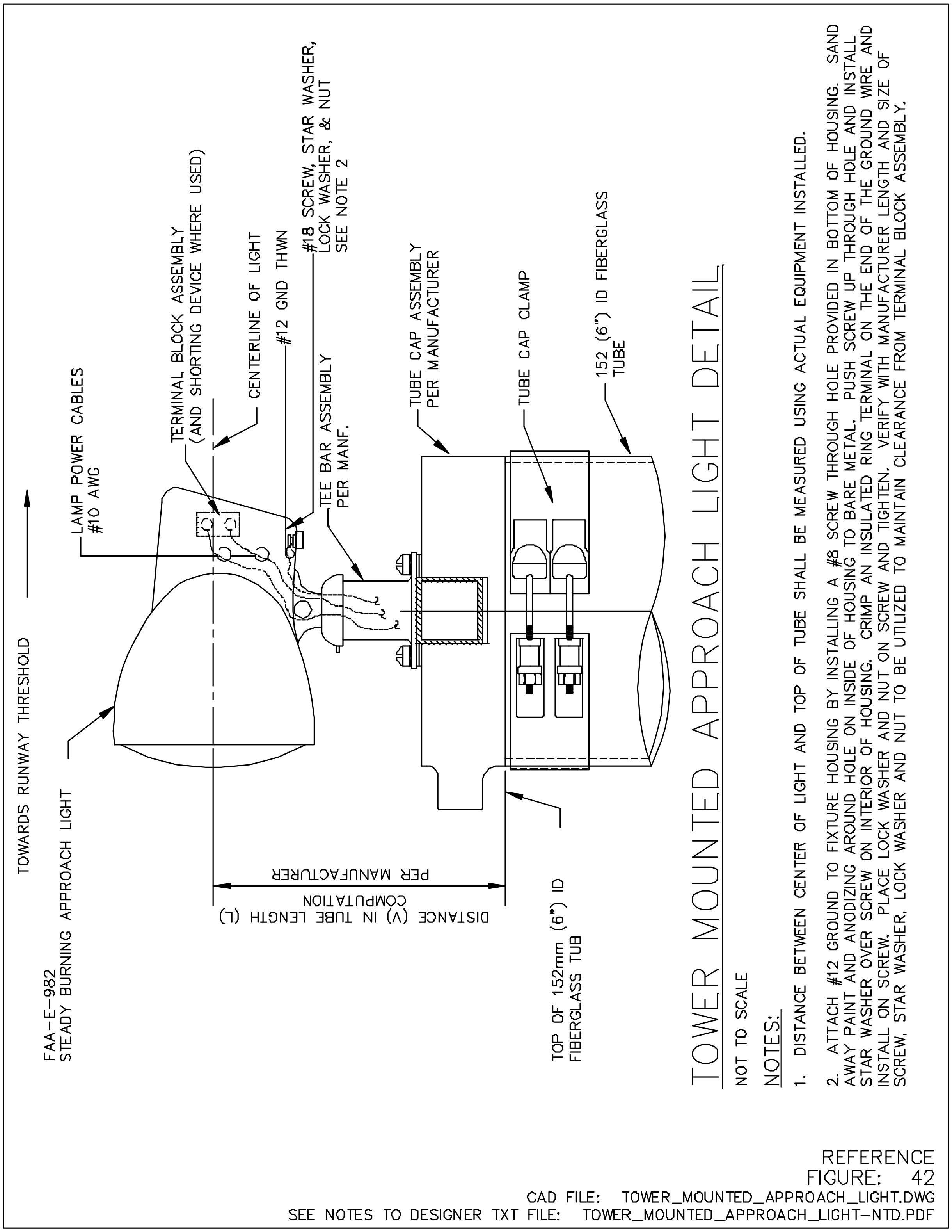


Figure 42. Tower Mounted Approach Light Detail

4.13. Tower Mounted SFL and Approach Light Detail

See figure 43.

Notes to Designer:

1. The flasher equipment ground conductor may be bonded to the ground conductor for the steady burn lights inside the tube cap assembly.

2. The number of conductors to the flasher must be verified. Typically, 2 #12 and 3 #16, 3kv, are used and are provided by the manufacturer. Ensure size of flexible conduit is adequate for these cables.

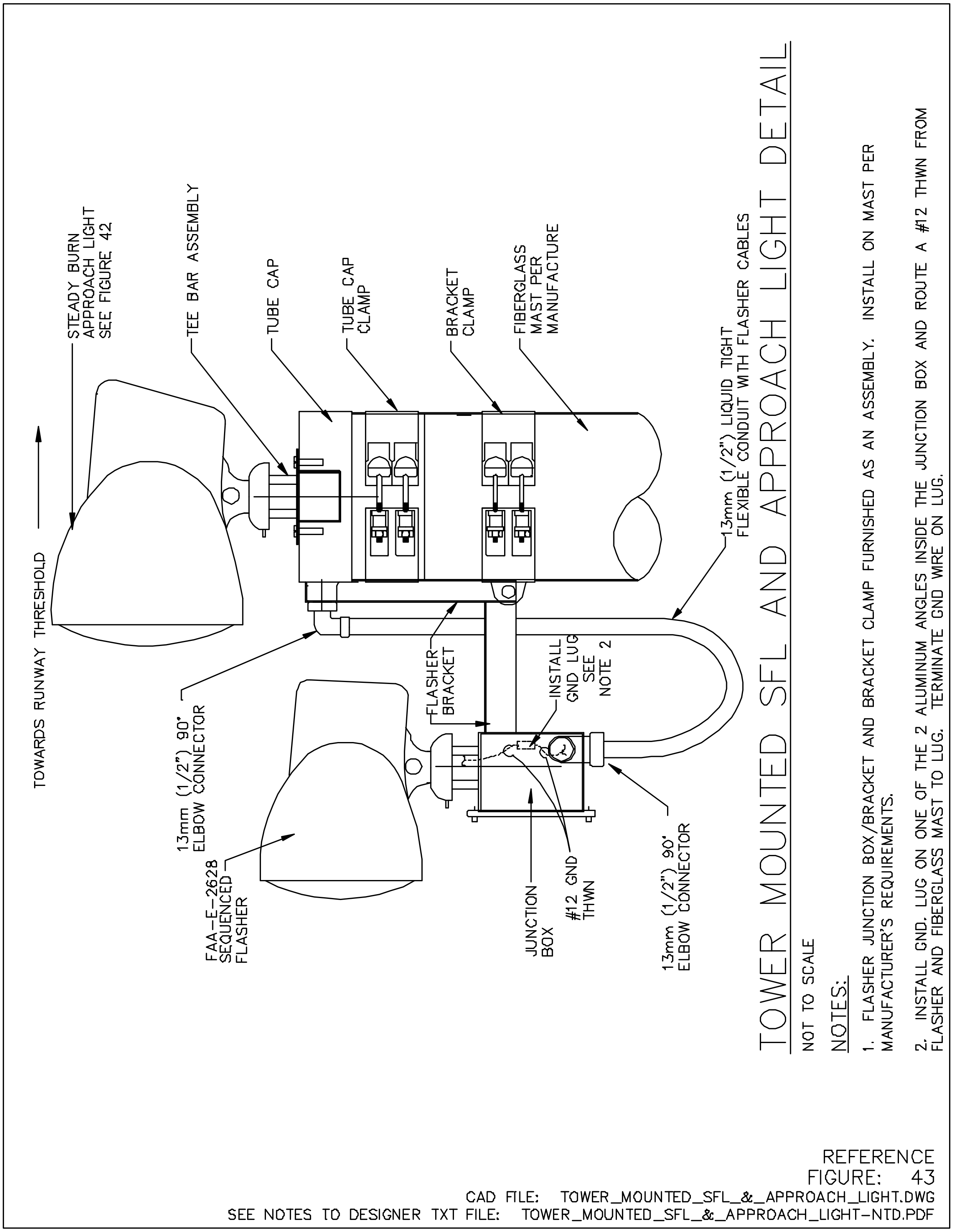


Figure 43. Tower Mounted SFL and Approach Light Detail

4.14. MALSR and SSALR Approach Light System Configuration

See figure 44.

Notes to Designer:

1. Recommend including the system layout as part of the contract documents.

2. The SSALR configuration may be achieved with a dual mode ALSF/SSALR system and is used when Category 1 weather conditions exist thereby allowing an energy savings without having to use the full ALSF-2 system.

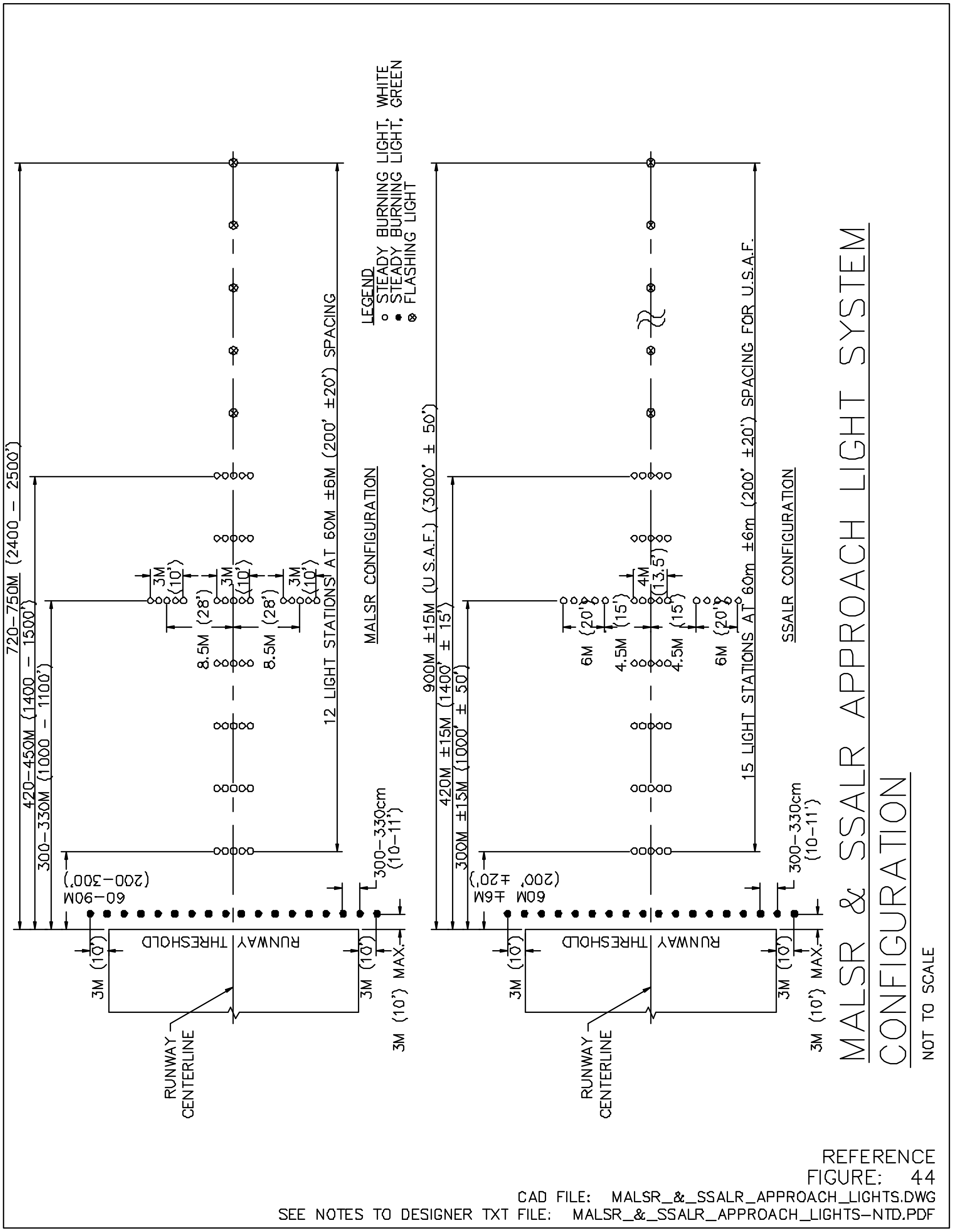


Figure 44. MALSR and SSALR Approach Light System Configuration

4.15. Remote Flasher Installation 1828mm (6' 0") Maximum

See figure 45.

Notes to Designer:

1. This detail shows a remote flasher installation. The high voltage cable is normally supplied with the flasher and about 15.2M (50') in length. Locate the flasher power supply within this distance.

2. Where the flasher is co-located with an approach light bar; the flasher may be mounted a maximum 1.5M (5') in front of light bar and a maximum of 1.3M (4') below the centerline of the approach light plane. When the flashers are mounted below the centerline, they must be uniformly mounted throughout the system.

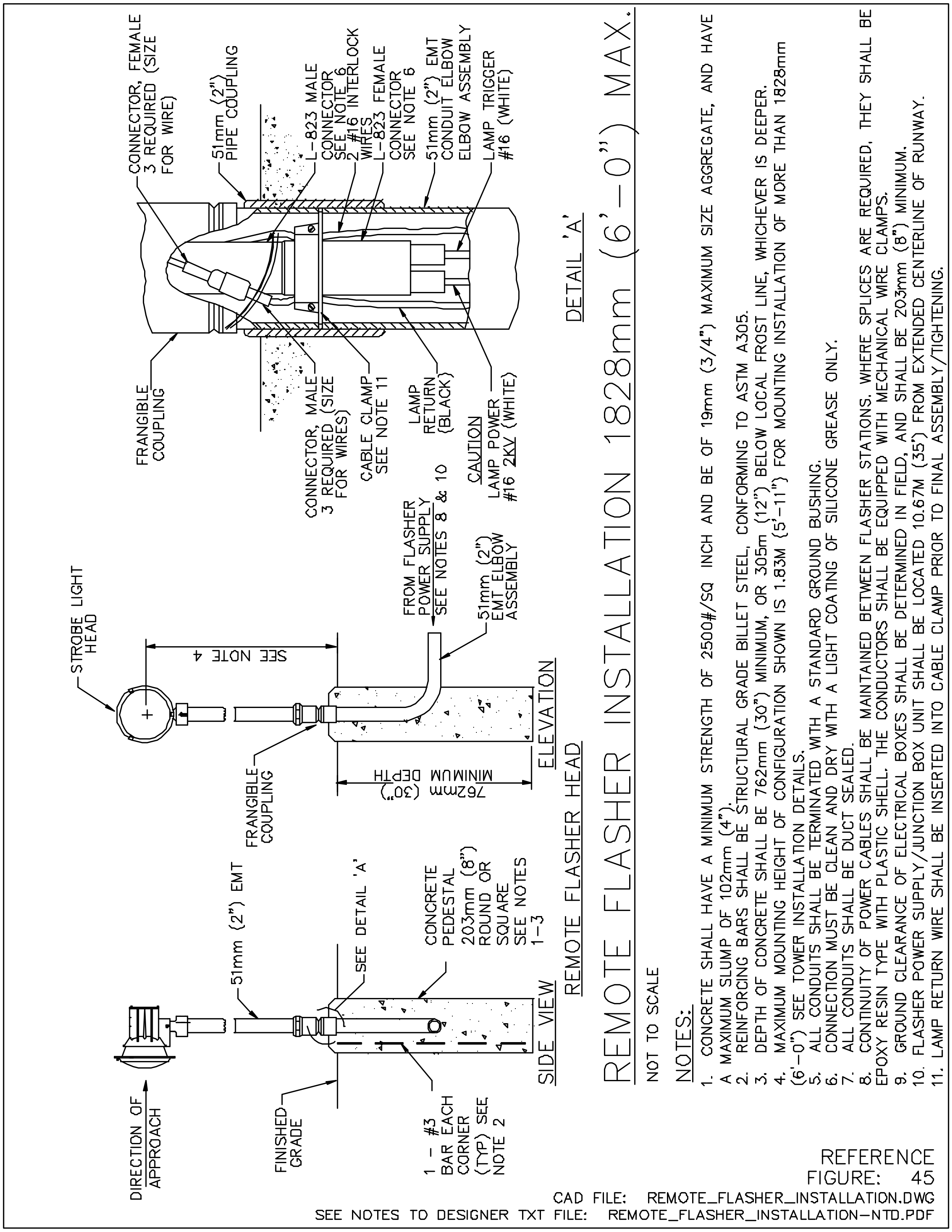


Figure 45. Remote Flasher Installation 1828mm (6' 0") Maximum

4.16. Typical High Intensity Approach Light Bar

See figure 46.

Notes to Designer:

Figure is self-explanatory.

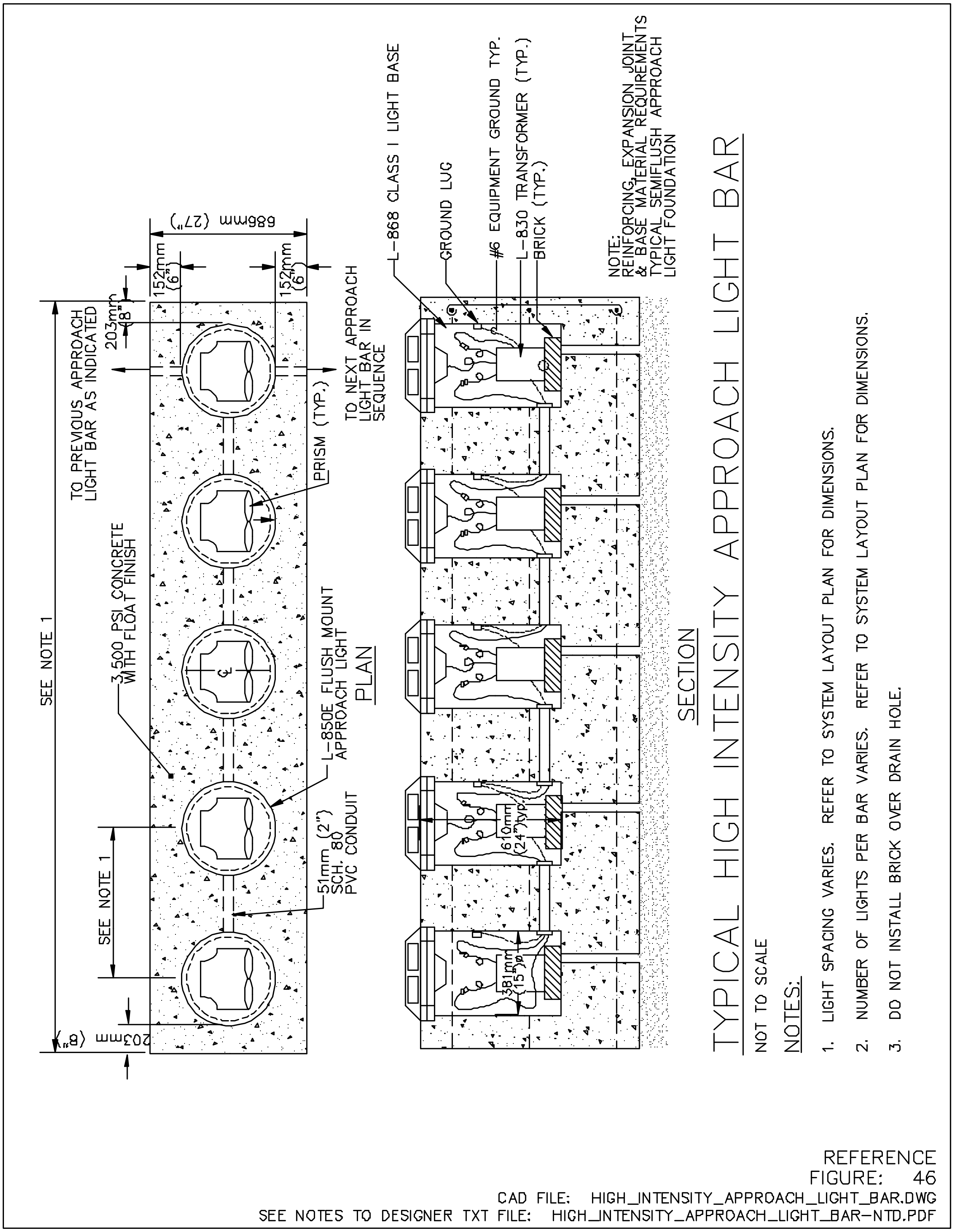


Figure 46. Typical High Intensity Approach Light Bar

4.17. Typical Elevated High Intensity Approach Light Bar 0mm to 1828mm (0’ to 6’0”) Maximum

See figure 47.

Notes to Designer:

1. This detail shows the elevated approach light bar. Spacing between the lights will depend on which system is installed.

2. The contract documents should contain an overall layout plan showing the spacing of the lights. Refer to Volume I for the spacing requirements for each system.

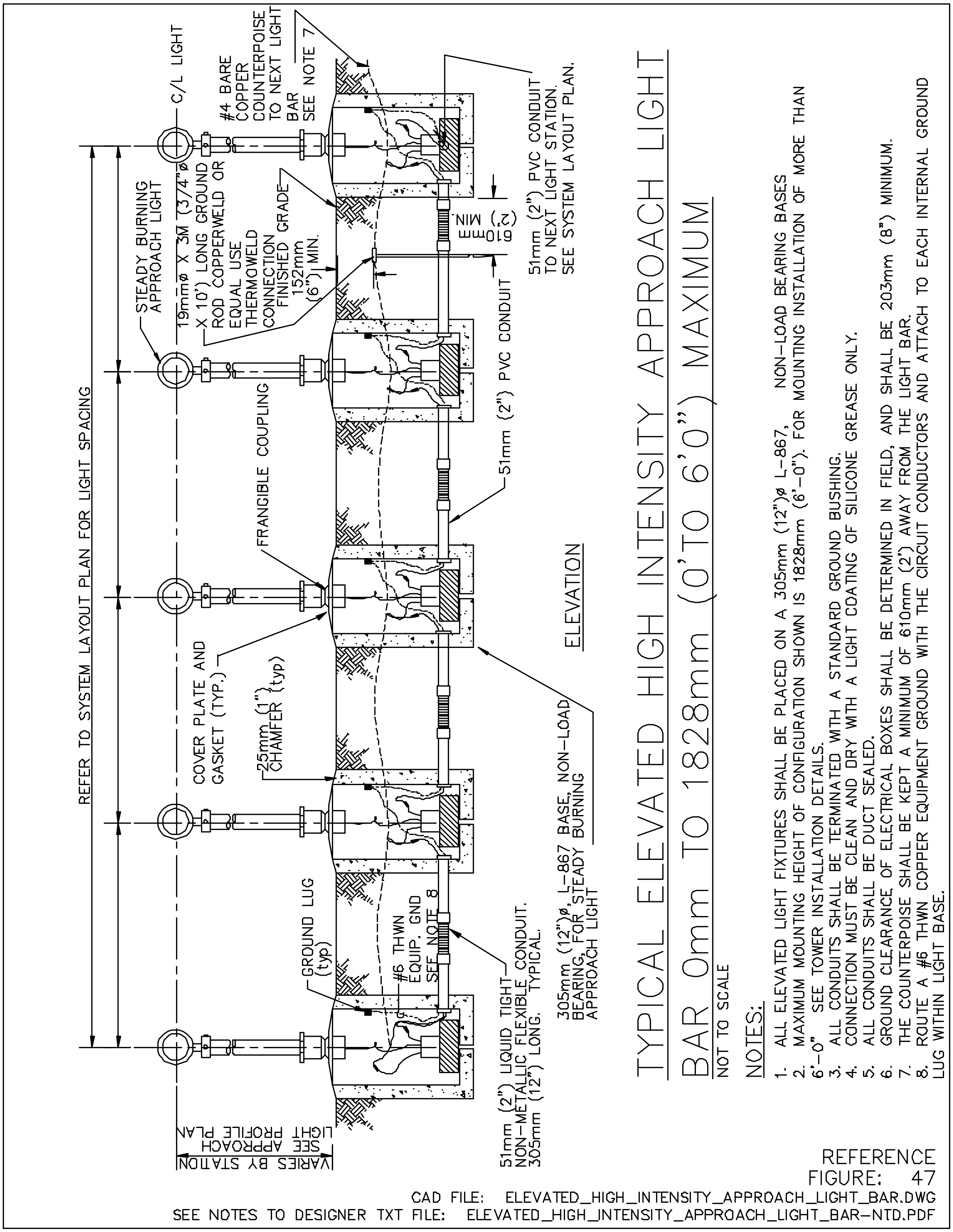


Figure 47. Typical Elevated High Intensity Approach Light Bar 0mm to 1828mm (0' to 6'0") Maximum

4.18. Typical Semiflush High Intensity Approach/Threshold Light Foundation

See figure 48.

Notes to Designer:

1. This detail shows a typical foundation for a semiflush light bar or threshold.

2. No more than five lights should be in a bar before an expansion joint is installed.

3. Ensure photometric requirements are specified. Threshold lights must meet 10,000 CD min. average for a high intensity system.

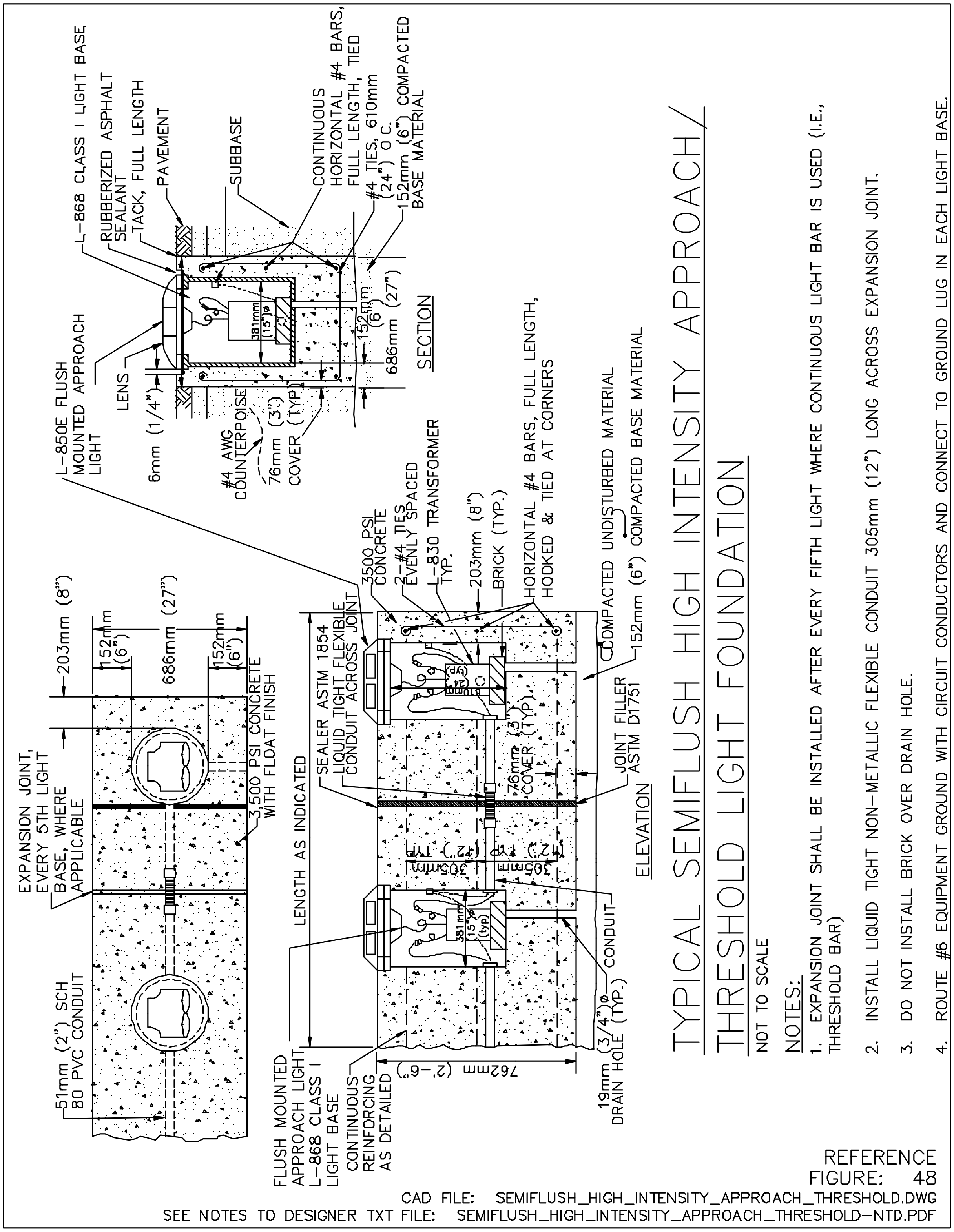


Figure 48. Typical Semiflush High Intensity Approach/Threshold Light Foundation

4.19. Typical Elevated High Intensity Approach/Threshold Light 1828mm (6’0”) Maximum

See figure 49.

Notes to Designer:

1. The color filter used is dictated by the system.

2. Ensure proper lamp wattage is utilized to meet the photometric requirements specified in Volume I. Recommend specifying photometric requirements in the contract documents.

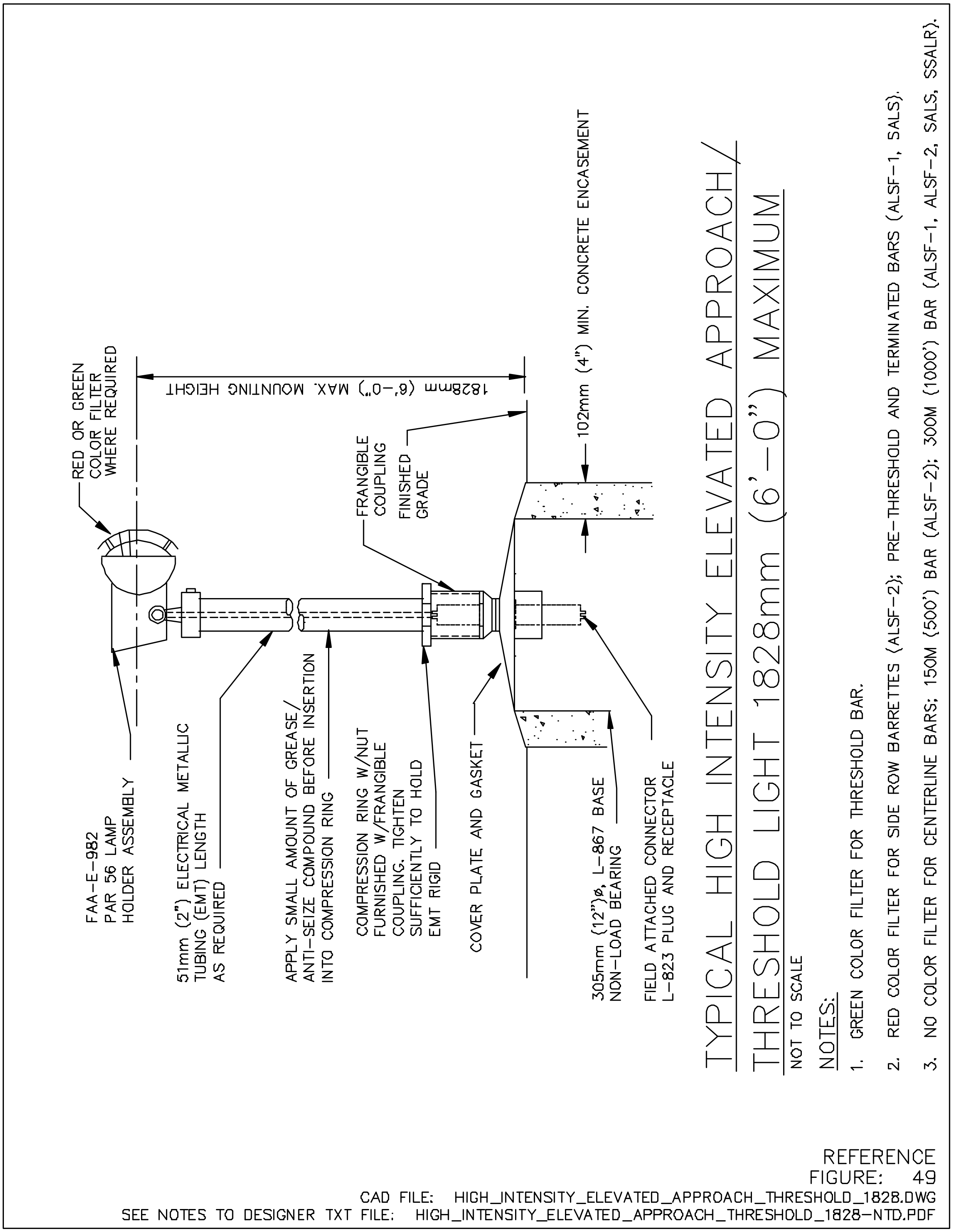


Figure 49. Typical Elevated High Intensity Approach/Threshold Light 1828mm (6'0") Maximum

4.20. ALSF-1 Approach Light System Configuration

See figure 50.

Notes to Designer:

1. Recommend including the system layout as part of the contract documents.

2. Currently, there is no high intensity bidirectional semiflush threshold/end light that meets the photometric requirements. Utilize L-850E with green filters for the threshold and L-850E with red filters for the end lights. Co-locate the end lights with the corresponding threshold light between the runway threshold and 610mm (24”) from the threshold light bar.

3. Manufacturers are currently testing light fixtures to be used as a semiflush bidirectional threshold/end light.

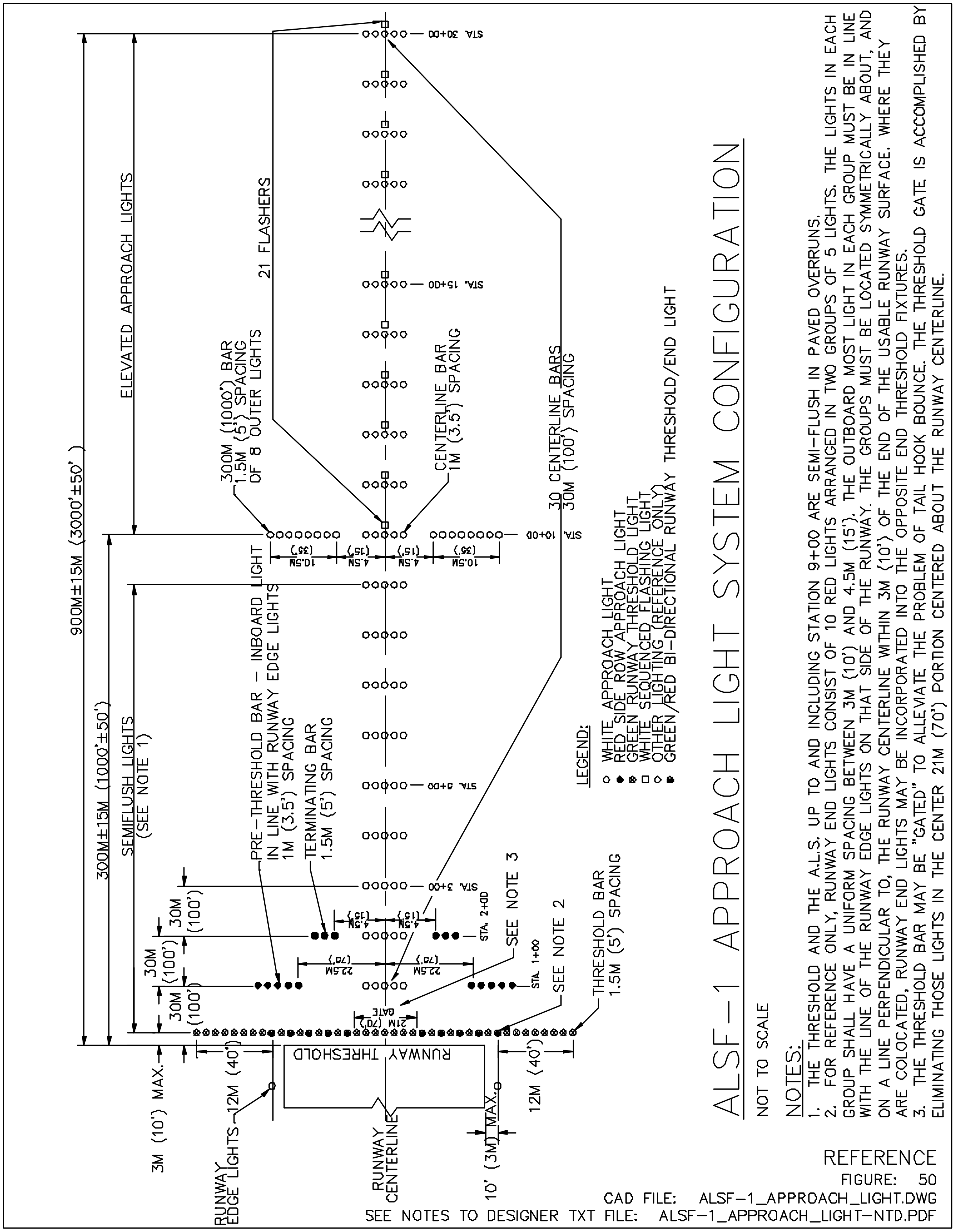


Figure 50. ALSF-1 Approach Light System Configuration

4.21. ALSF-2 Approach Light System Configuration

See figure 51.

Notes to Designer:

1. Recommend including the system layout as part of the contract documents.

2. Currently, there is no high intensity bidirectional semiflush threshold/end light that meets the photometric requirements. Utilize L-850E with green filters for the threshold and L-850E with red filters for the end lights. Co-locate the end lights with the corresponding threshold light between the runway threshold and 610mm (24”) from the threshold light bar.

3. Manufacturers are currently testing light fixtures to be used as a semiflush bidirectional threshold/end light.

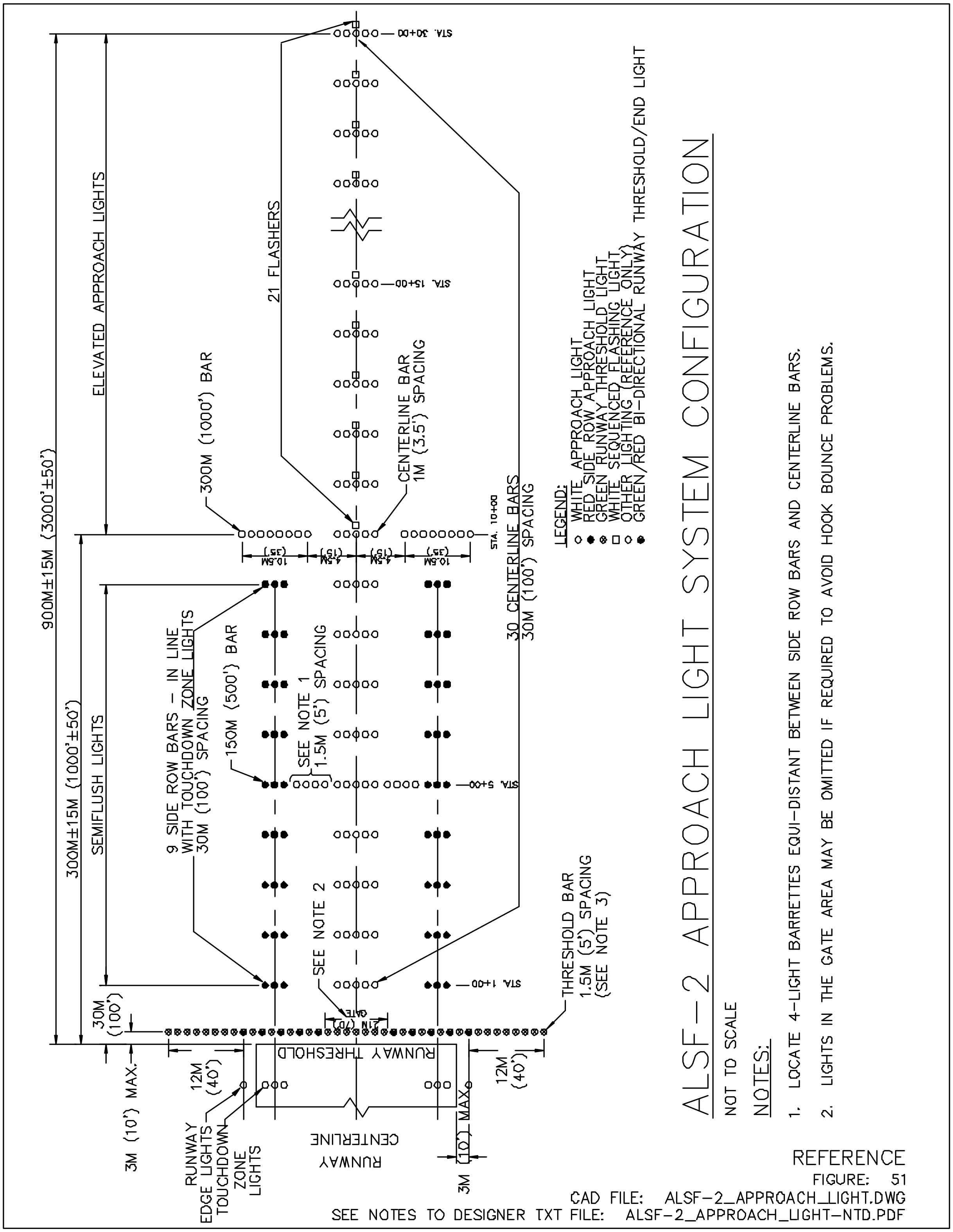


Figure 51. ALSF-2 Approach Light System Configuration

4.22. MALSR Wiring Diagram

See figure 52.

Notes to Designer:

1. The MALSR system is a constant voltage (parallel) system. When designing system close attention must be given to voltage drop.

2. The MALSR system utilizes the same type of LIR structures as the high intensity ALSF systems. The light spacing on the T-bar assembly is different, however, and the lamp holder is for a PAR 38 in lieu of a PAR 56 as used on a high intensity system.

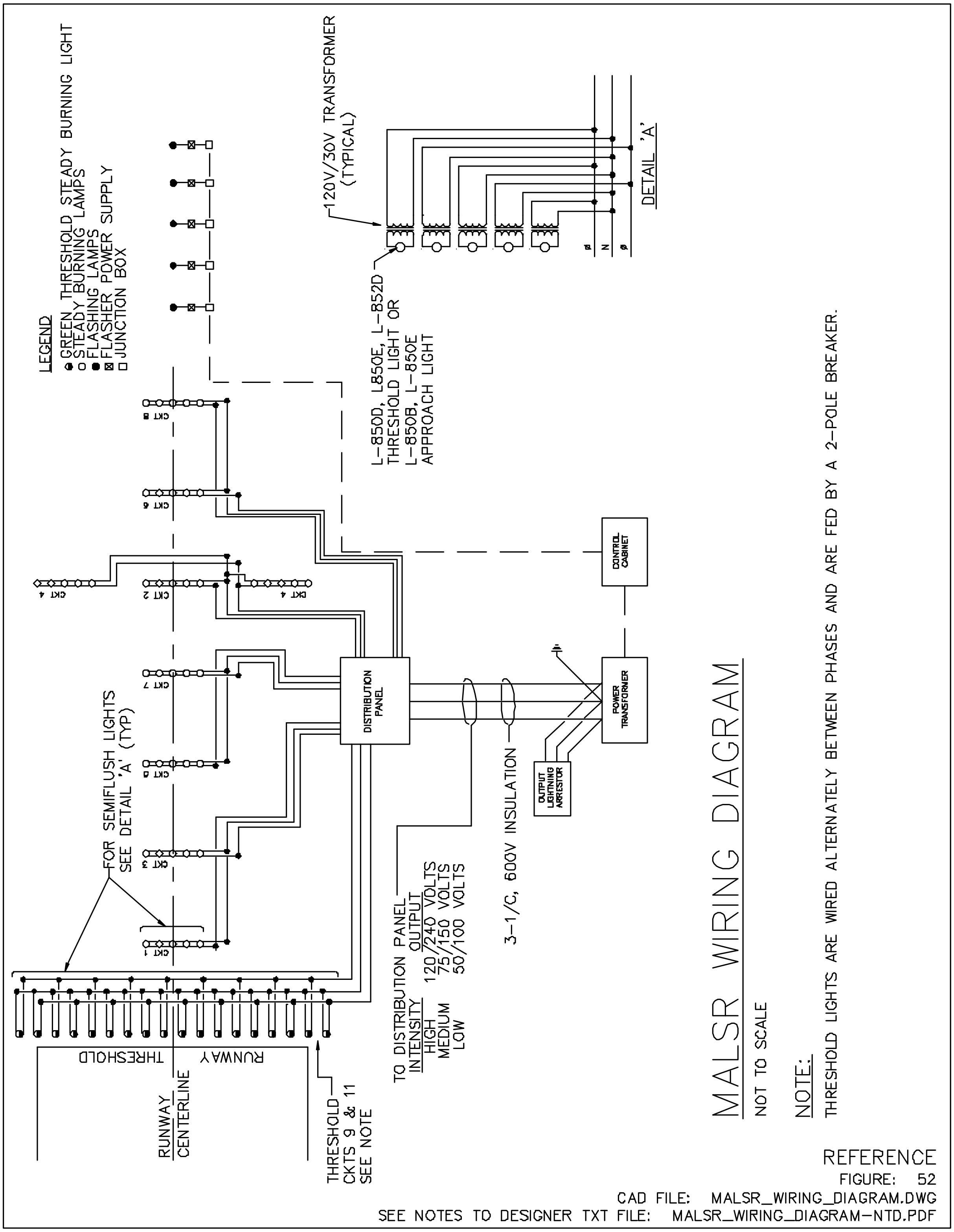


Figure 52. MALSR Wiring Diagram

4.23. SSALR Wiring Diagram

See figure 53.

Notes to Designer:

1. Typically high intensity approach light systems are 20 amp circuits. The size of the regulators depends on the fixtures to be used. On major upgrades or new installations recommend researching the use of most recent 200 watt 6.6 amp lamp that meets the photometric requirements for the steady burn lamp. An energy savings and smaller regulator size may result. Refer to Volume I for more information.

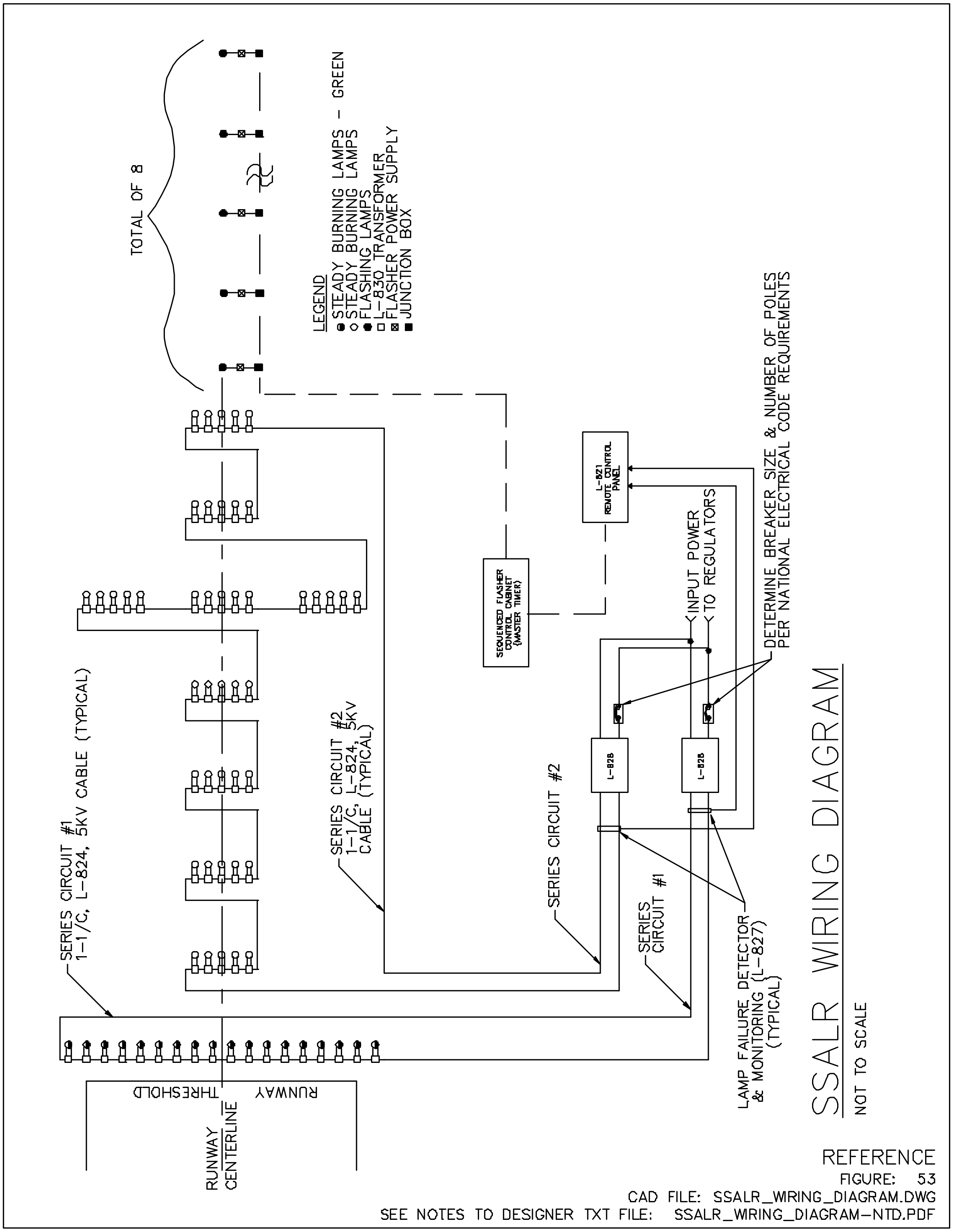


Figure 53. SSALR Wiring Diagram

4.24. L.I.R. Structure MS-20

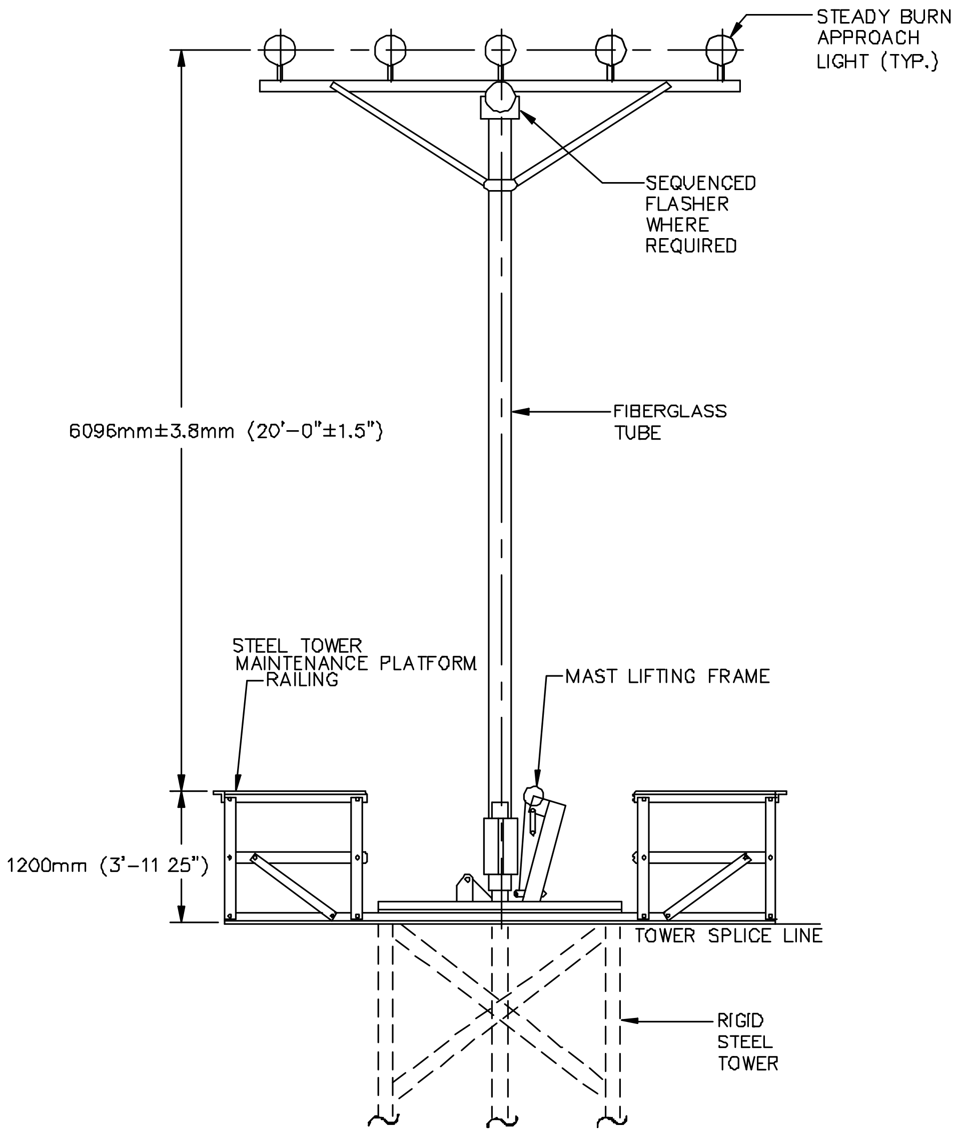
See figure 54.

Notes to Designer:

1. The MS-20 structure is manufactured by Jaquith Industries and includes the crossbar and lowering device. Jaquith provides standard details for mounting the MS-20 structure onto the tower platform. These details should be given to the proposed tower manufacturer.

2. Conduit and wiring details for the structure should be included in the contract documents. Conduit size and number of conductors will depend on the number and types of lights installed. Approved manufacturers of approach light systems should be consulted.

3. If a sequenced flasher is to be installed, the flasher power supply should be installed on the maintenance platform and the flasher junction box should be installed at grade. However, if installation is in a flood plane or wet area both flasher power supply and junction box should be installed on the maintenance platform. Cables may then be routed underground or aerially.



REFERENCE
FIGURE: 54
CAD FILE: LIR_STRUCTURE_MS-20.DWG
SEE NOTES TO DESIGNER TXT FILE: LIR_STRUCTURE_MS-20-NTD.PDF

LIR STRUCTURE MS-20

NOT TO SCALE

NOTES:

1. INSTALLATION OF MAST LIFTING FRAME, FIBERGLASS TUBE AND LIGHTS PER MANUFACTURER'S REQUIREMENTS.

2. MAINTENANCE PLATFORM SHALL BE INSTALLED ON STEEL TOWER PER MANUFACTURER'S REQUIREMENTS.

Figure 54. L.I.R. Structure MS-20

4.25. Approach Light Structure 12.2M to 39M (40’ to 128’)

See figure 55.

Notes to Designer:

1. The top 6M (20’) of the structure is the low impact resistant portion of the overall structure. The height of the required rigid steel tower is determined by subtracting 6M (20’) for the L.I.R. structure and 1.2M (3’-11.25”) for the maintenance platform and railing from the overall height as shown in the approach light system profile plan.

2. Prior to designing the foundation for the tower, borings should be taken in the field for soil analysis. Many factors will affect the type and size of foundation to be installed (i.e. type of soil, existence of rock or ledge, soil bearing capacity, frost depth, etc.). The designer should base the foundation design on these factors and consult with the tower manufacturer regarding EPA (Effective Projected Area) for wind loading. The wind loading shall include the proposed fixtures and hardware to be installed on the tower.

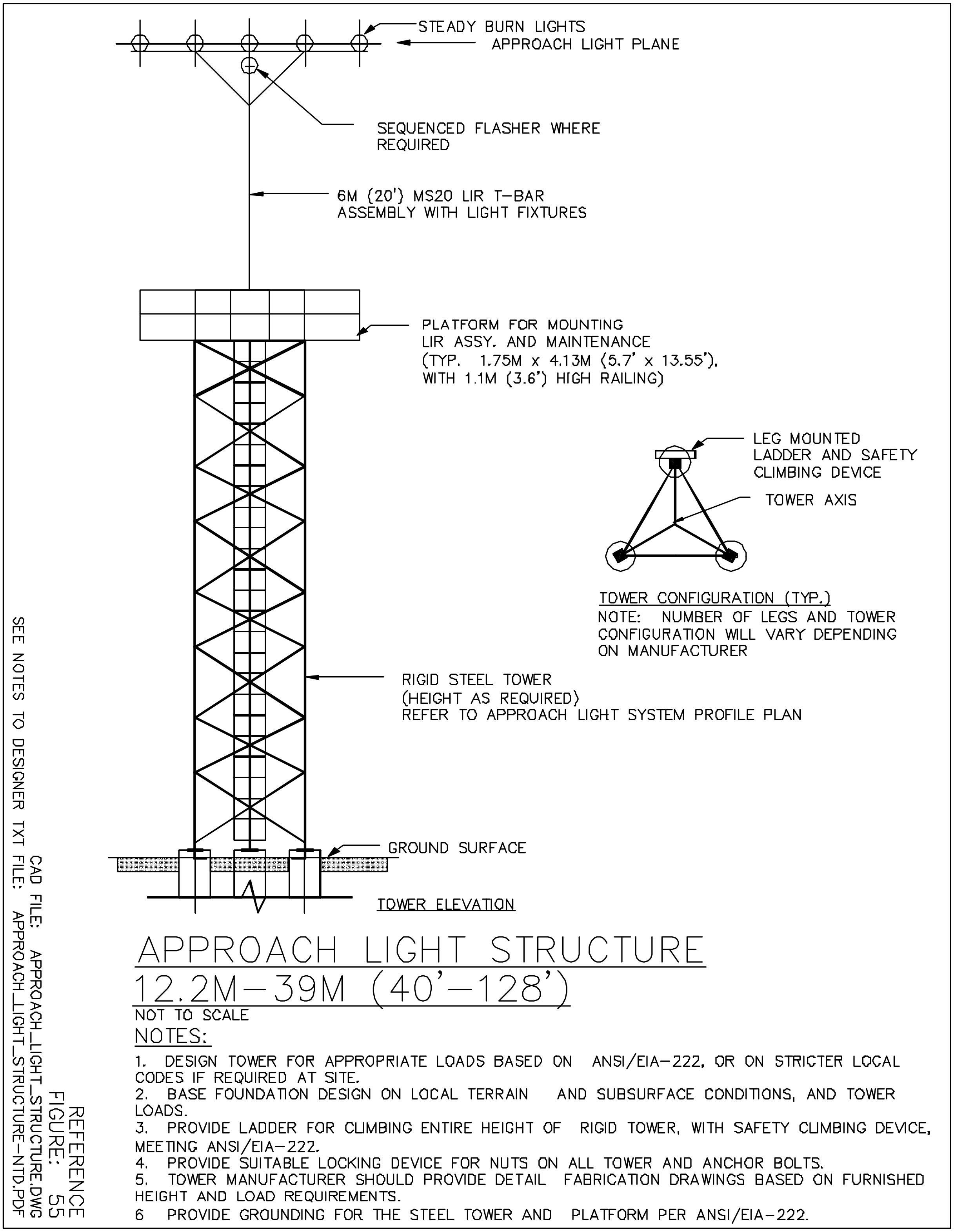


Figure 55. Approach Light Structure 12.2M to 39M (40' to 128')

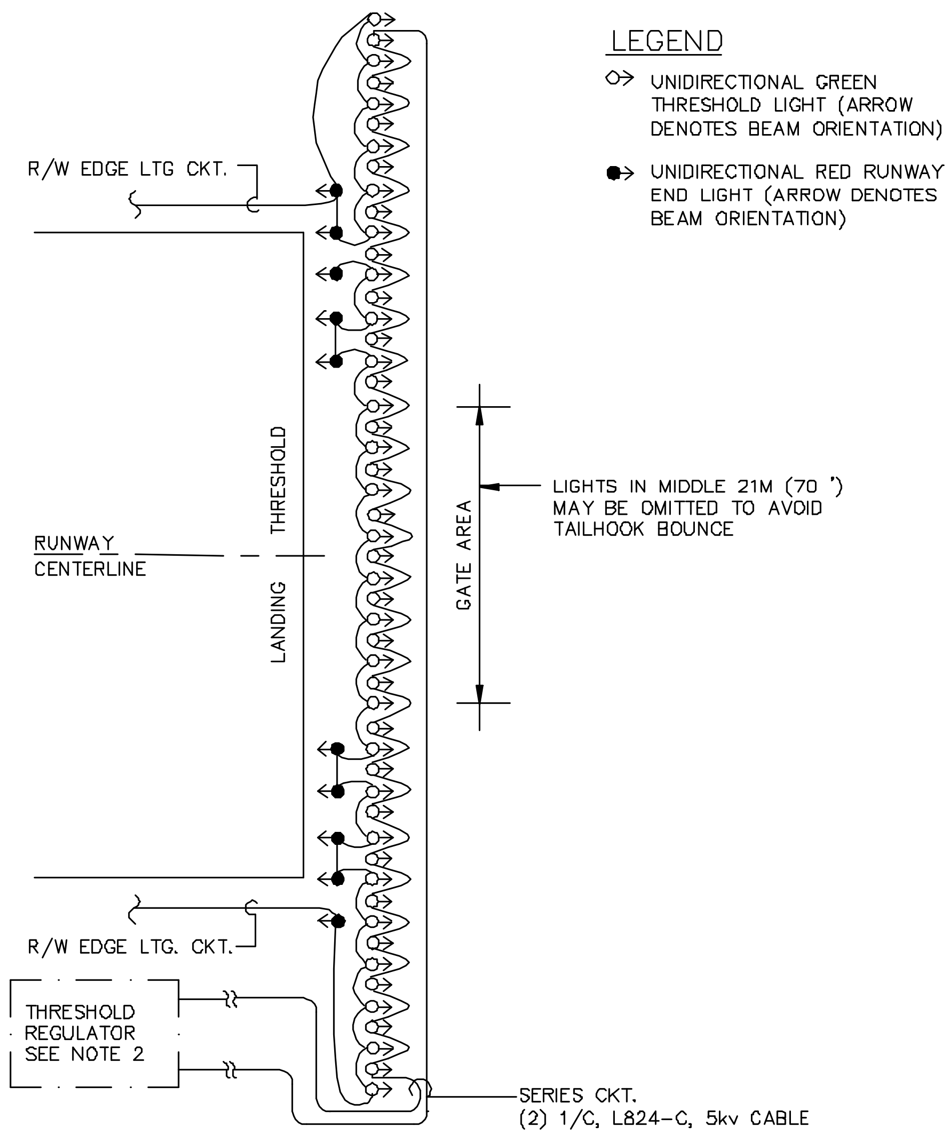
4.26. High Intensity Threshold Bar Wiring Diagram – Without Approach Lights (Method #1)

See figure 56.

Notes to Designer:

1. The total load for the threshold bar without approach lights and including lights in the gated area could be as high as 28.1kw with 51 elevated lights at 550 watts each including transformer losses. Recommend specifying in the contract documents a threshold light regulator that would operate in conjunction with the runway edge lights.

2. Circuiting should be split between the runway and threshold regulators. As a minimum, the runway end lights and their co-located threshold lights should be on the runway circuit. The different circuits should cause a symmetrical pattern about the runway centerline.



HIGH INTENSITY THRESHOLD BAR WIRING DIAGRAM – WITHOUT APPROACH LIGHTS (METHOD #1)

NOT TO SCALE

NOTES:

1. THE RUNWAY END LIGHT MAY BE INCORPORATED IN A BIDIRECTIONAL FIXTURE WITH RED AND GREEN COLOR FILTERS, PROVIDED THE PHOTOMETRICS FOR THRESHOLD AND END LIGHTS ARE MET.
2. CONTROL CKT'S FOR THRESHOLD REGULATOR SHALL BE WIRED IN PARALLEL WITH CONTROL CKT'S. FOR RUNWAY EDGE LIGHT REGULATOR(S) SUCH THAT THRESHOLD LIGHTS ARE ENERGIZED AND AT SAME INTENSITY AS RUNWAY EDGE LIGHTS.

REFERENCE FIGURE: 56
CAD FILE: HIGH_INTENSITY_THRESHOLD_BAR-WO.DWG
SEE NOTES TO DESIGNER TXT FILE: HIGH_INTENSITY_THRESHOLD_BAR-WO-NTD.PDF

Figure 56. High Intensity Threshold Bar Wiring Diagram – Without Approach Lights (Method #1)

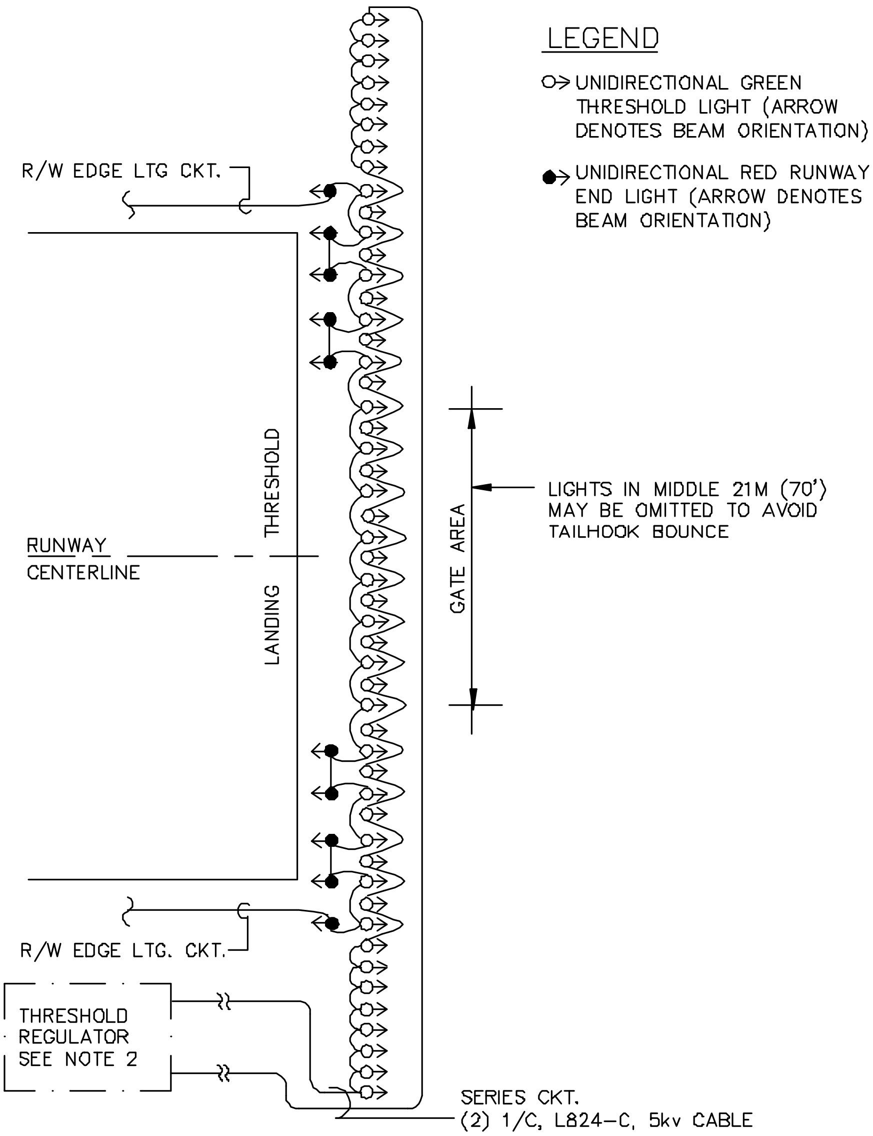
4.27. High Intensity Threshold Bar Wiring Diagram – Without Approach Lights (Method #2)

See figure 57.

Notes to Designer:

1. The total load for the threshold bar without approach lights and including lights in the gated area could be as high as 28.1Kw with 51 elevated lights at 550 watts each including transformer losses. Recommend specifying in the contract documents a threshold light regulator that would operate in conjunction with the runway edge lights.

2. Circuiting should be split between the runway and threshold regulators. As a minimum, the runway end lights and their co-located threshold lights should be on the runway circuit. The different circuits should cause a symmetrical pattern about the runway centerline.



HIGH INTENSITY THRESHOLD BAR WIRING DIAGRAM – WITHOUT LIGHTS (METHOD #2)

NOT TO SCALE

NOTES:

1. THE RUNWAY END LIGHT MAY BE INCORPORATED IN A BIDIRECTIONAL FIXTURE WITH RED AND GREEN COLOR FILTERS, PROVIDED THE PHOTOMETRICS FOR THRESHOLD AND END LIGHTS ARE MET.
2. CONTROL CIRCUITS FOR THRESHOLD REGULATOR SHALL BE WIRED IN PARALLEL WITH CONTROL CIRCUITS. FOR RUNWAY EDGE LIGHT REGULATOR(S) SUCH THAT THRESHOLD LIGHTS ARE ENERGIZED AND AT SAME INTENSITY AS RUNWAY EDGE LIGHTS.

REFERENCE
FIGURE: 57
CAD FILE: HIGH_INTENSITY_THRESHOLD_BAR-WO2.DWG
SEE NOTES TO DESIGNER TXT FILE: HIGH_INTENSITY_THRESHOLD_BAR-WO2-NTD.PDF

Figure 57. High Intensity Threshold Bar Wiring Diagram – Without Approach Lights (Method #2)

4.28. High Intensity Threshold Bar Wiring Diagram – With Approach Lights

See figure 58.

Notes to Designer:

1. When an approach light system is installed, part of the threshold bar will be circuited with the approach lights and part will be circuited with the runway edge lights.

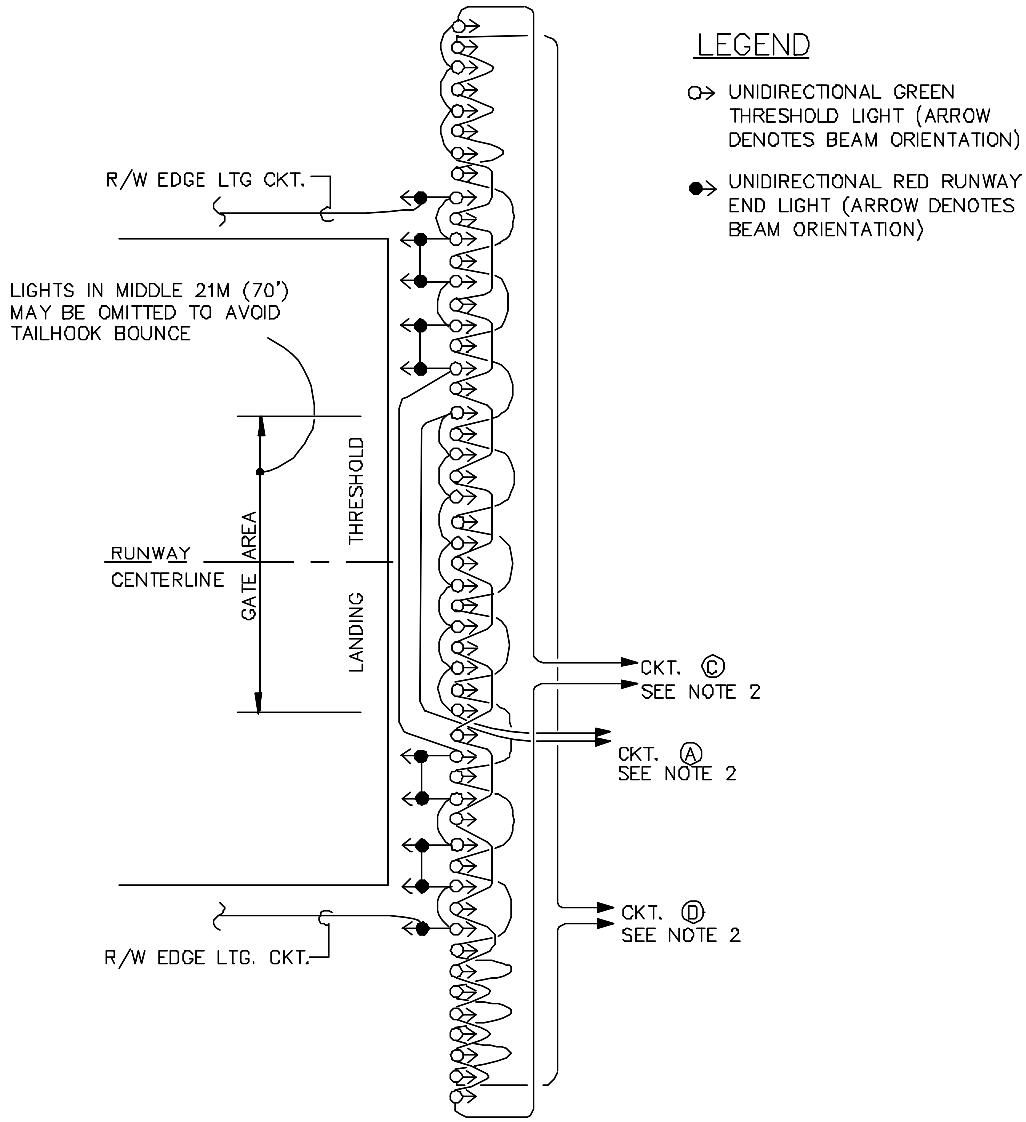
2. Coordinate circuiting with the approach light system and maintain a symmetrical pattern about the runway centerline.

3. As shown in the DWG:

   - R/W LTG CKT turns on the runway end lights and corresponding co-located approach light.

   - CKT A is the SSALR circuit of a dual mode ALSF/SSALR approach lighting system. With the R/W lights and CKT A turned on, the threshold bar light pattern is that of an SSALR configuration.

   - CKTs C and D complete the light pattern for a full ALSF mode and are circuited such that no two adjacent fixtures are on the same circuit. All circuits are on (R/W, A, C, D) for a full ALSF system.



HIGH INTENSITY THRESHOLD BAR WIRING DIAGRAM – WITH APPROACH LIGHTS

NOT TO SCALE

NOTES:

1. THE RUNWAY END LIGHT MAY BE INCORPORATED IN A BIDIRECTIONAL FIXTURE WITH RED AND GREEN COLOR FILTERS, PROVIDED THE PHOTOMETRICS FOR THRESHOLD AND END LIGHTS ARE MET.

2. REFER TO HIGH INTENSITY ALSF/SSALR WIRING DIAGRAMS FOR CONTINUATION.

REFERENCE FIGURE: 58
CAD FILE: HIGH_INTENSITY_THRESHOLD_BAR-W.DWG
SEE NOTES TO DESIGNER TXT FILE: HIGH_INTENSITY_THRESHOLD_BAR-W-NTD.PDF

Figure 58. High Intensity Threshold Bar Wiring Diagram – With Approach Lights

4.29. High Intensity ALSF-1/SSALR Wiring Diagram

See figure 59.

Notes to Designer:

1. When designing the approach light system, several factors must be taken into account:
   - Each regulator should be equal in kw capacity,
   - No two adjacent light bars should be on the same circuit, and
   - Circuiting should be symmetrical about the runway centerline.
2. Some locations may use a single 1500 watt isolation transformer to feed (5) 300 watt tower mounted lights.
3. The present trend is to limit the regulator size to 30kw, 20 amp. This is being done to lower the available voltage throughout the system for safety reasons. Also, the trend may be to utilize 6.6 amps rather than 20 amps and newly developed light sources.

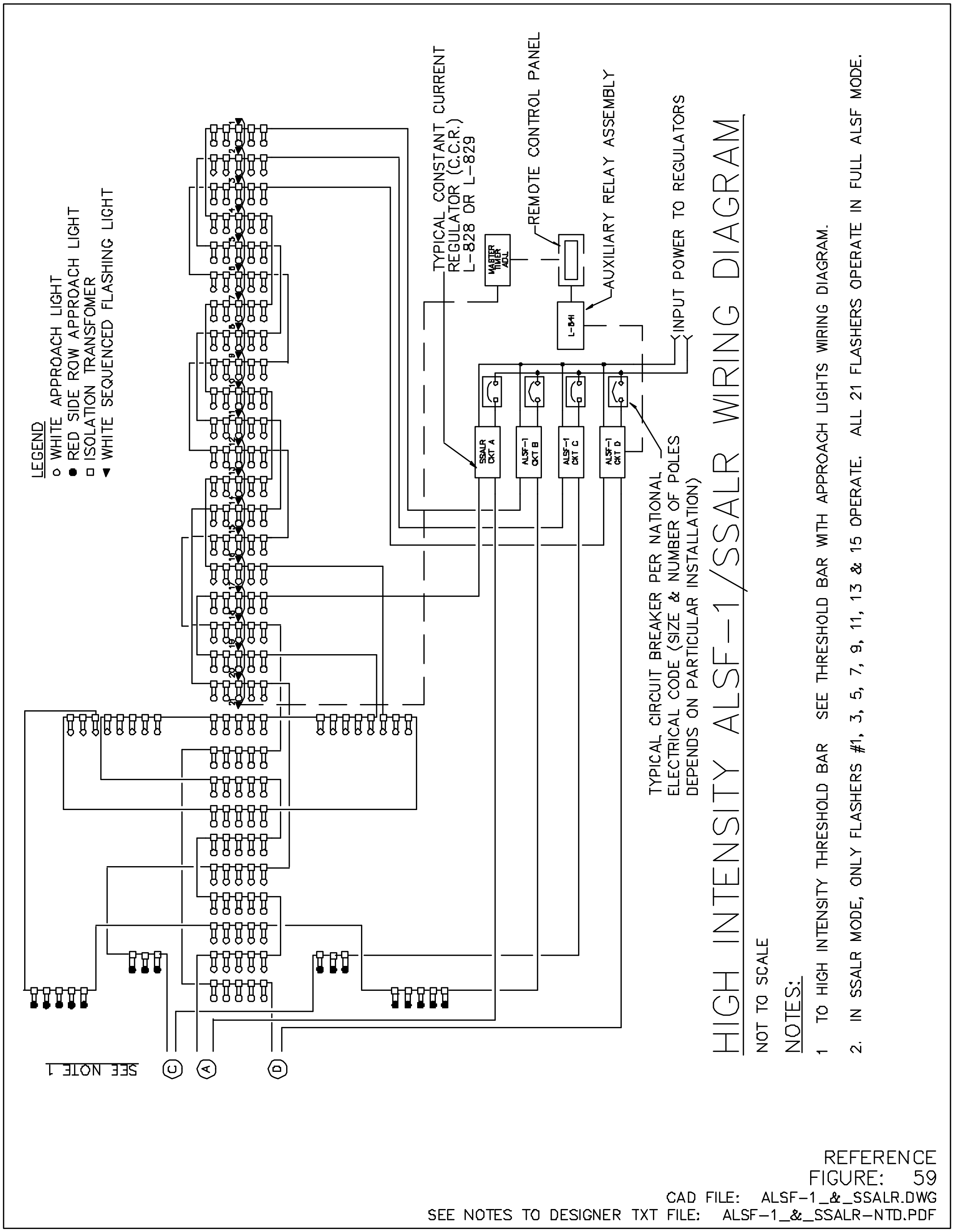


Figure 59. High Intensity ALSF-1/SSALR Wiring Diagram

4.30. High Intensity ALSF-2/SSALR Wiring Diagram

See figure 60.

Notes to Designer:

1. When designing the approach light system, several factors must be taken into account:
   - Each regulator should be equal in kw capacity,
   - No two adjacent light bars should be on the same circuit, and
   - Circuiting should be symmetrical about the runway centerline.
2. Some locations may use a single 1500 watt isolation transformer to feed (5) 300 watt tower mounted lights.
3. The present trend is to limit the regulator size to 30kw, 20 amp. This is being done to lower the available voltage throughout the system for safety reasons. Also, the trend may be to utilize 6.6 amps rather than 20 amps and newly developed light sources.
4. This wiring diagram depicts the latest circuiting from the FAA utilizing (5) 30kw regulators in lieu of (3) 50kw regulators used in older systems.

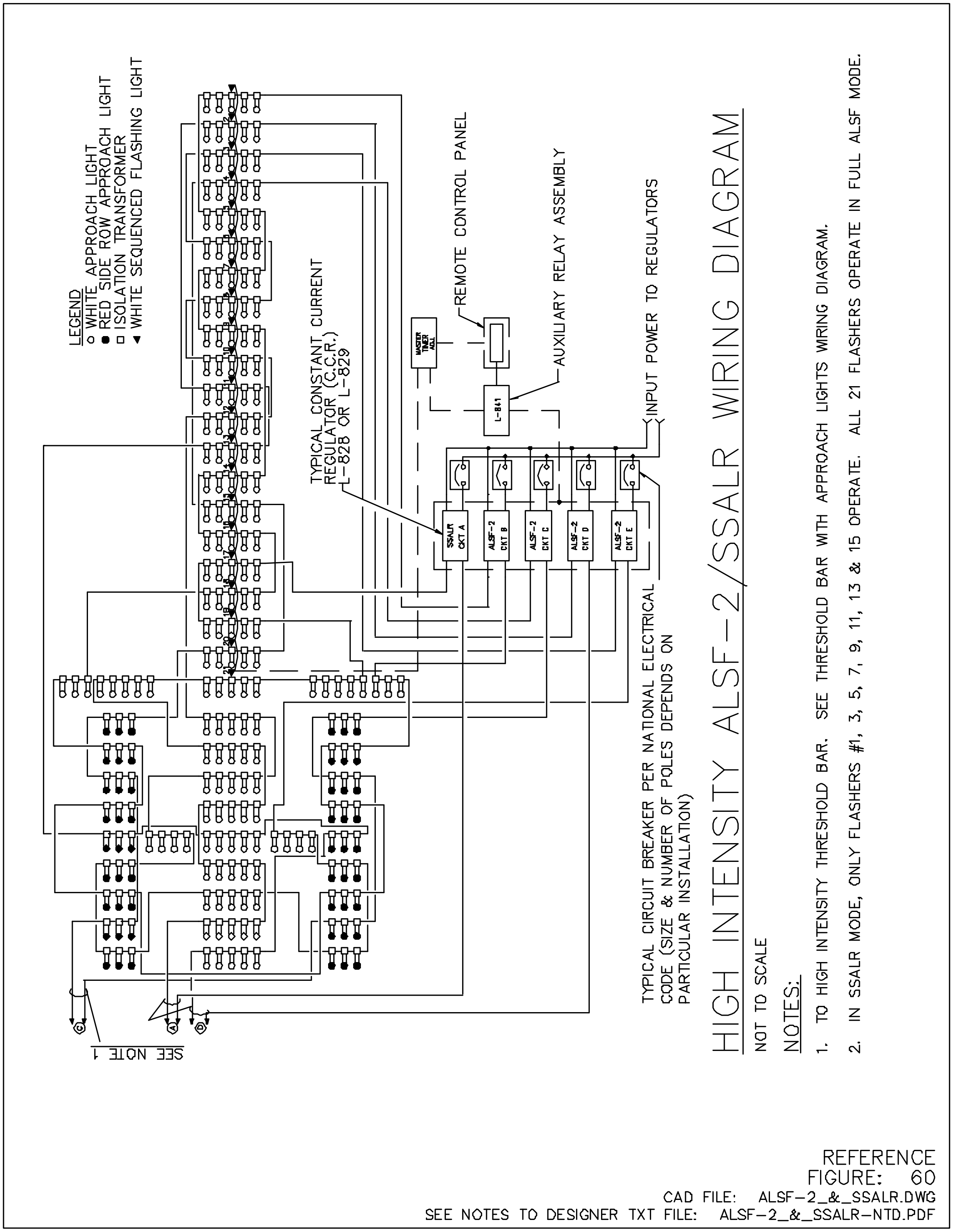


Figure 60. High Intensity ALSF-2/SSALR Wiring Diagram

Chapter 5: PAPI AND REIL SYSTEMS

5.1. FAA L-880 Style A (Constant Voltage) PCU Mounting Details

See figure 61.

Notes to Designer:

1. Verify with manufacturer mounting dimensions and hardware.
2. Pad size shown in minimum for this particular unit.

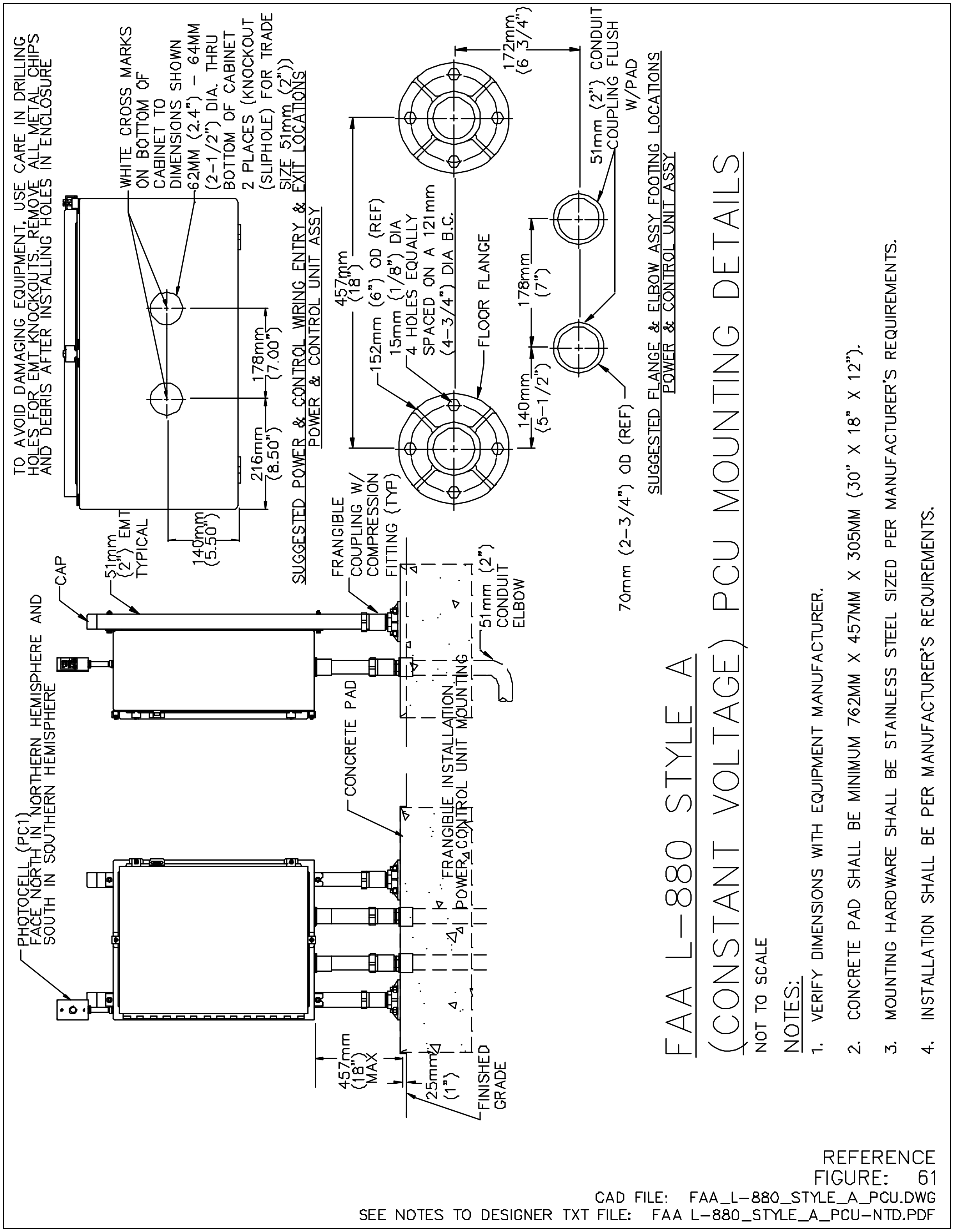


Figure 61. FAA L-880 style A (Constant Voltage) PCU Mounting Details

5.2. FAA L-880 Style A (Constant Voltage) System Wiring Diagram

See figure 62.

Notes to Designer:

1. The L-880 Style A uses a constant voltage to power the system. Intensity control is accomplished automatically by an integral photocell. The system is at maximum brightness during the daytime and lower brightness ≈ 20% during hours of darkness.

2. A constant voltage source must be available within the vicinity of the system. Design must take into account voltage drop back to the supply.

3. The three-lamp version is preferred. However, newer units utilizing two lamps that meet the photometric requirements have been developed.

4. Consult with manufacturer for power requirements.

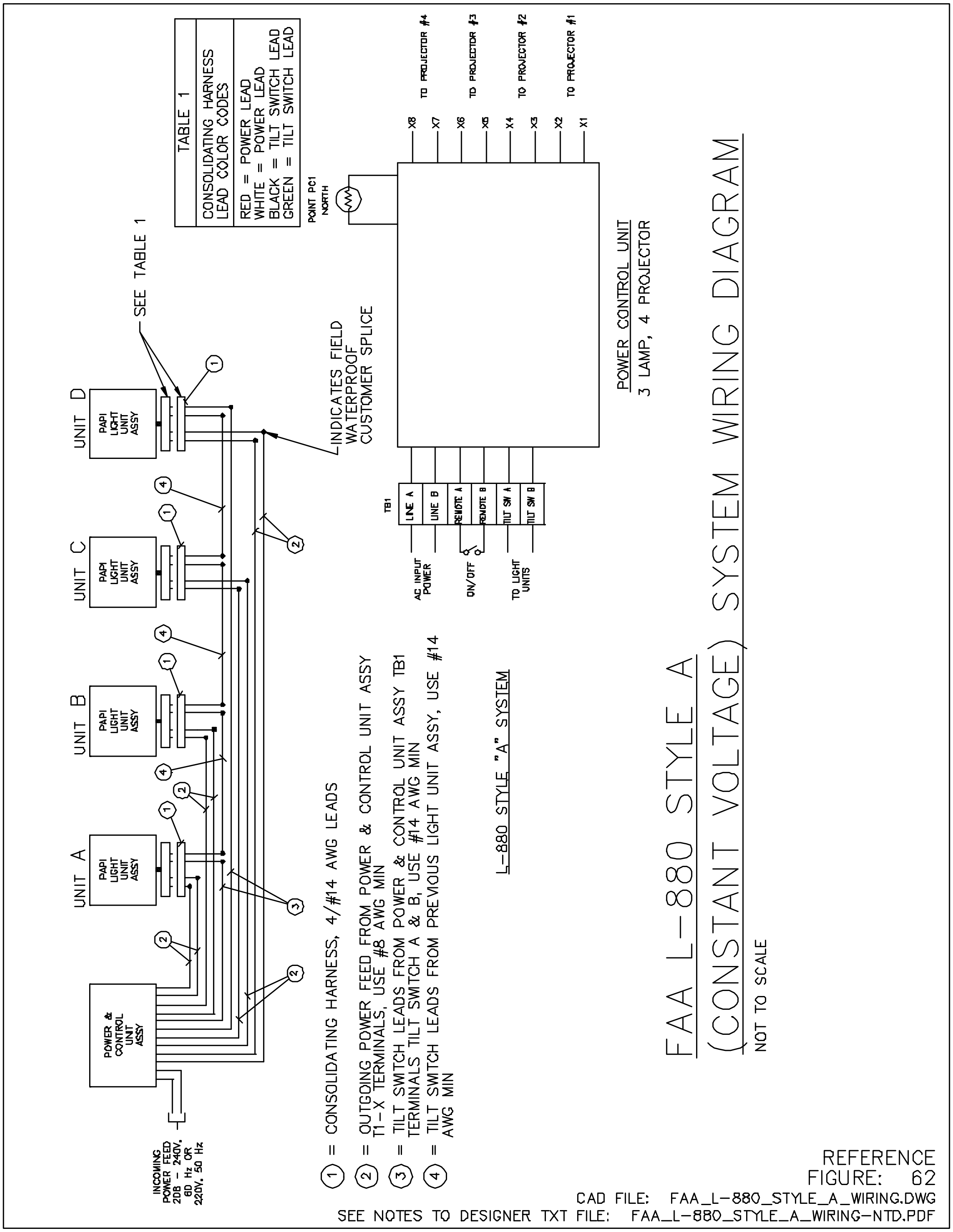


Figure 62. FAA L-880 Style A (Constant Voltage) System Wiring Diagram

5.3. FAA L-880 Style B (Constant Current) System Wiring Diagram

See figure 63.

Notes to Designer:

1. The L-880 Style B uses a constant current source to power the system. This is typically done using a 4kw constant current regulator with 5 brightness steps. Intensity is selected manually at the control panel in the tower or vault at airfields that have 24 hour tower control. A different control scheme is used at part time or unmanned tower airfields.

2. The three-lamp version is preferred. However, newer units utilizing two lamps that meet the photometric requirements have been developed.

3. Consult with manufacturer for power requirements.

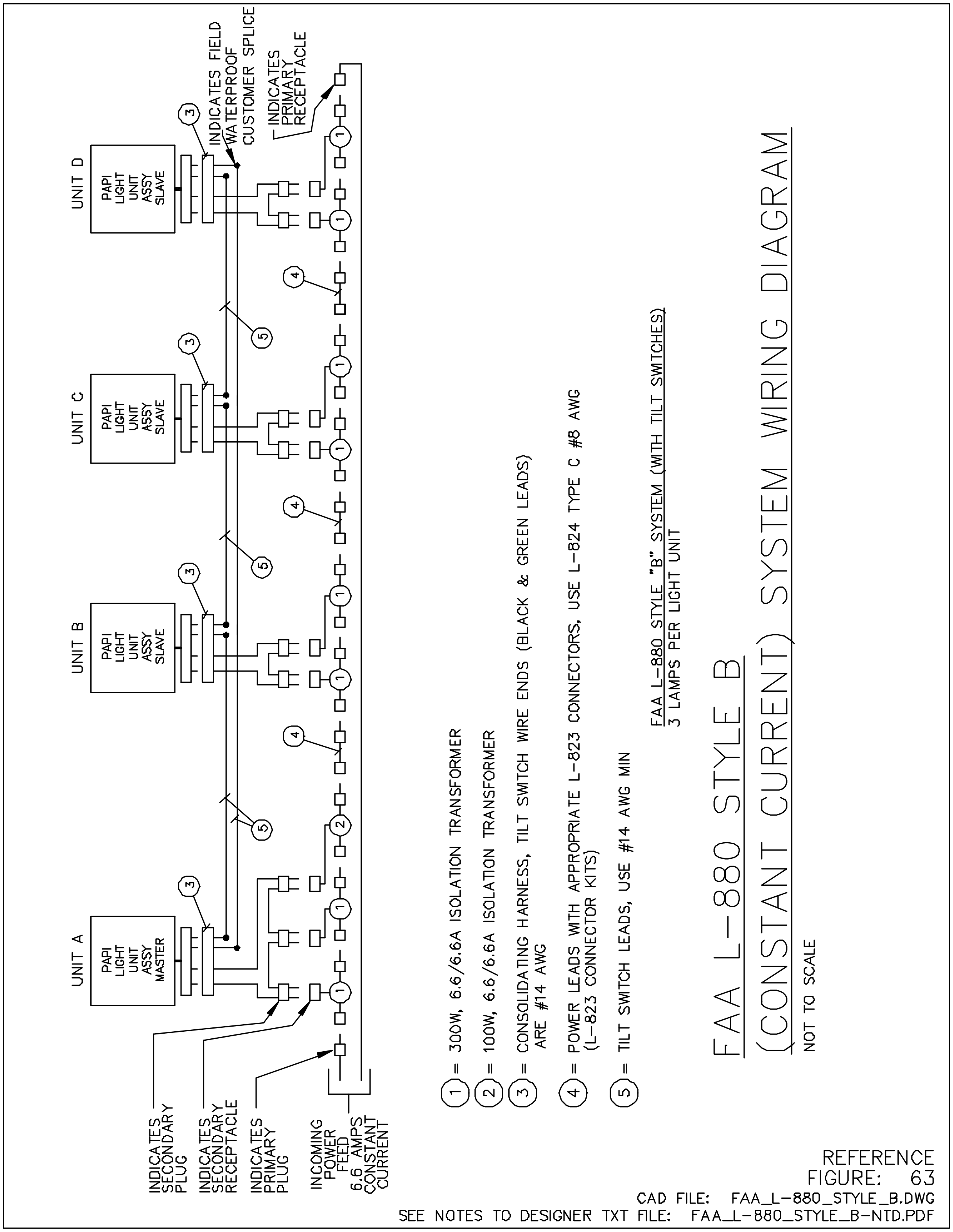


Figure 63. FAA L-880 Style B (Constant Current) System Wiring Diagram

5.4. FAA L-880 Style B (Constant Current) PAPI Power and Control Schematic Diagram

See figure 64.

Notes to Designer:

1. This detail shows a typical schematic diagram of a Style B system. The actual control diagram used will depend on site specific requirements.

2. Newer installations may use computer control systems with touch-screen monitors for the control panels.

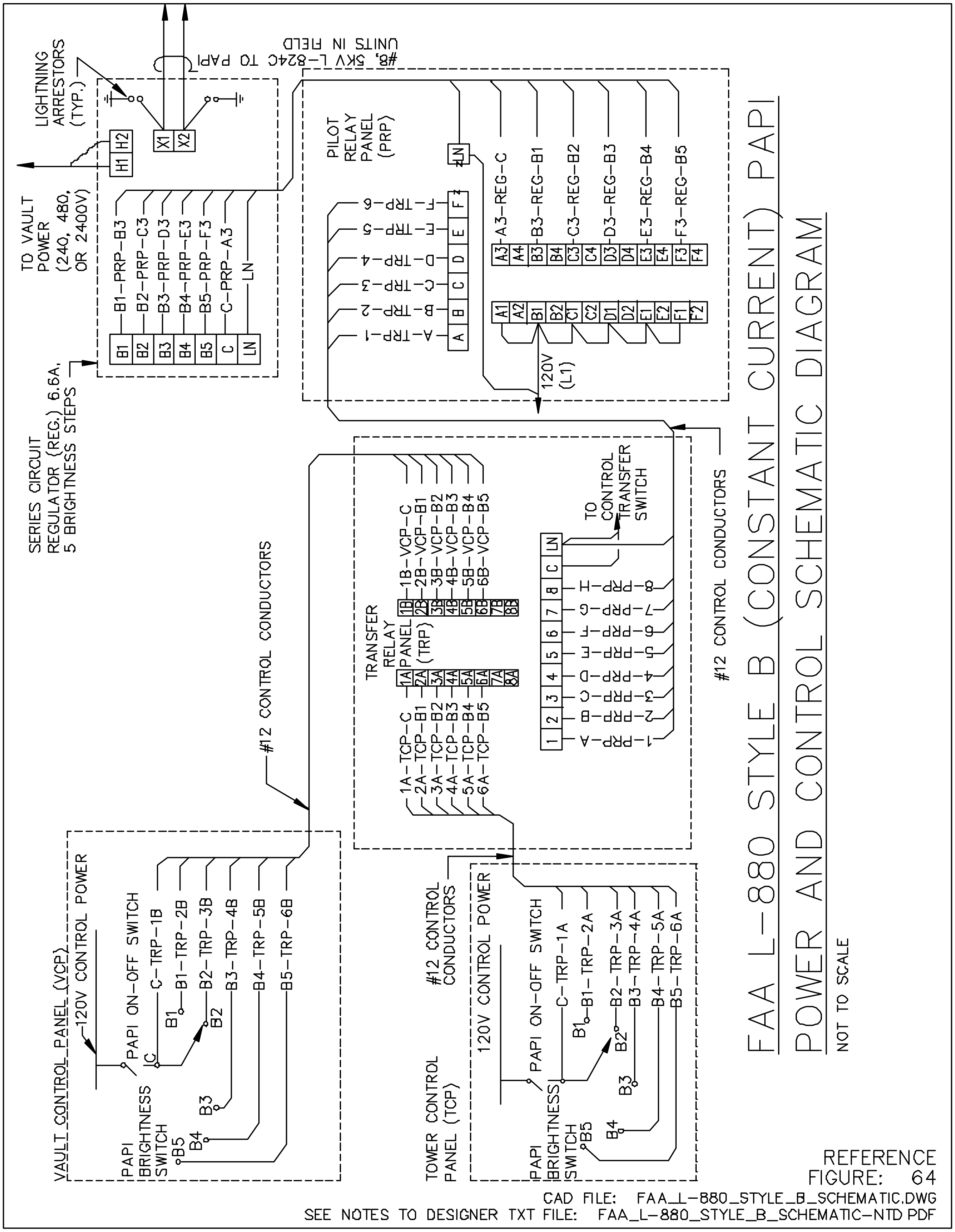


Figure 64. FAA L-880 style B (Constant Current) PAPI Power and Control Schematic Diagram

5.5. PAPI Light Housing Unit (LHU) Installation Detail

See figure 65.

Notes to Designer:

1. The contract documents should show location of PAPI units and aiming angles. Refer to Volume I for siting requirements.

2. Verify with manufacturer pad dimensions and number of openings in cover of L-867 can.

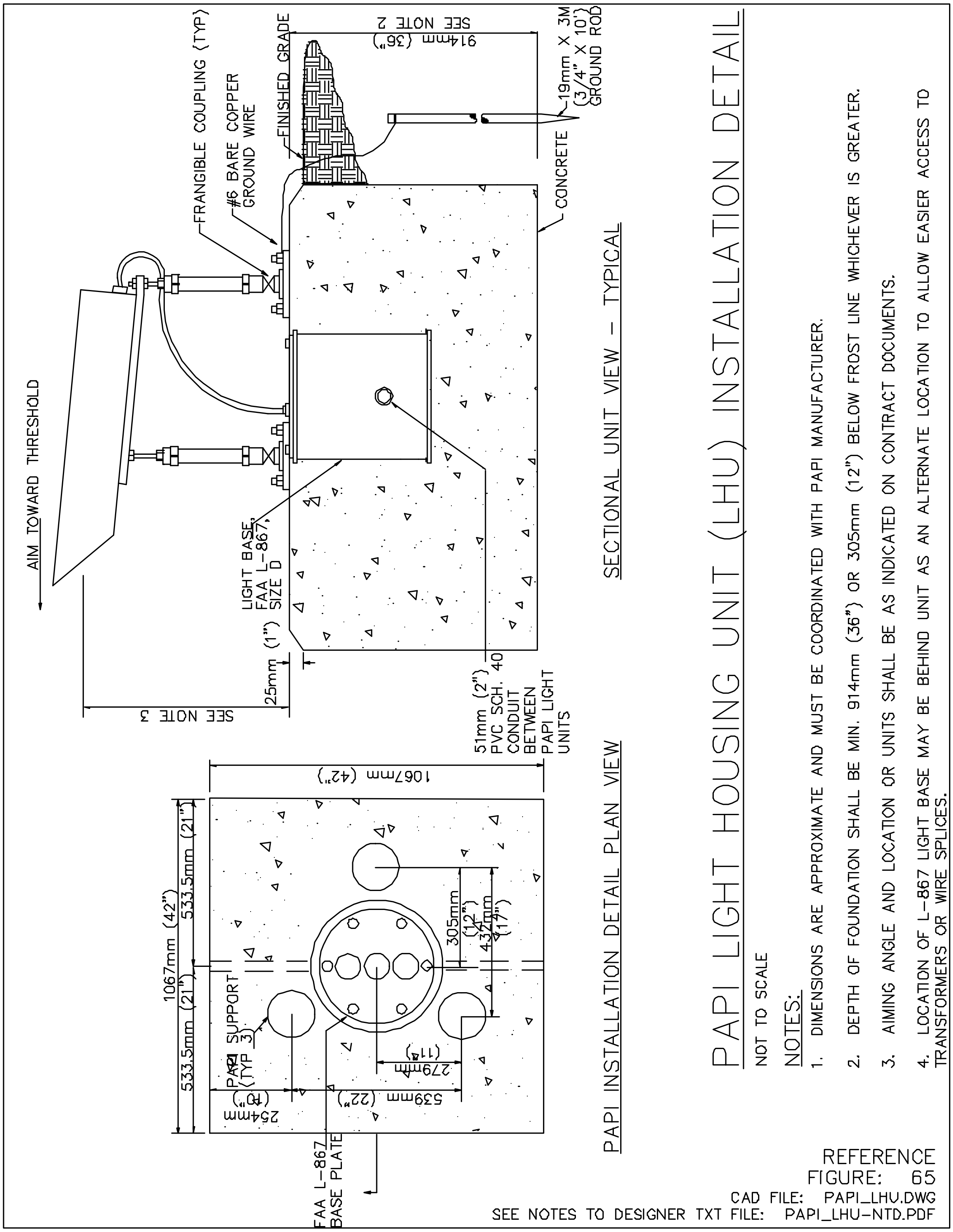


Figure 65. PAPI Light Housing Unit (LHU) Installation Detail

5.6. REIL Systems Schematic Wiring Diagrams

See figure 66.

Notes to Designer:

The most common system presently in use is depicted in Schematic A. This system uses a separate 120/240 volt source for the incoming power. When designing this system ensure the separate power source is available near the master unit.

Schematic B uses a power adapter that is installed in series with the series runway lighting circuit. The power adapter converts the constant current from the lighting circuit to a 120/240 volt output. This output is used as the 120/240 volt source to power the system.

Some special precautions should be taken when designing this type of system:

1. Power adapters often have varied performance. Variations in brightness levels selected, load, and regulators will produce variations in voltage output.

2. System may add up to an additional 4kw to runway lighting system.

3. System may not work well with certain types of regulators.

Recommend coordinating with manufacturer prior to designing this type of system.

Schematic C is a constant current system manufactured by Flash Technology Corporation of America. This type of system uses the constant current as the power feed to each unit via an L-830 isolation transformer. The flash heads are synchronized via the twisted pair between the two units. Load on the runway lighting circuit is about 150 watts per flash head or 300 watts for the system.

The contract documents should only show the schematic wiring diagram of the actual system to be utilized. Designer should delete the other diagrams.

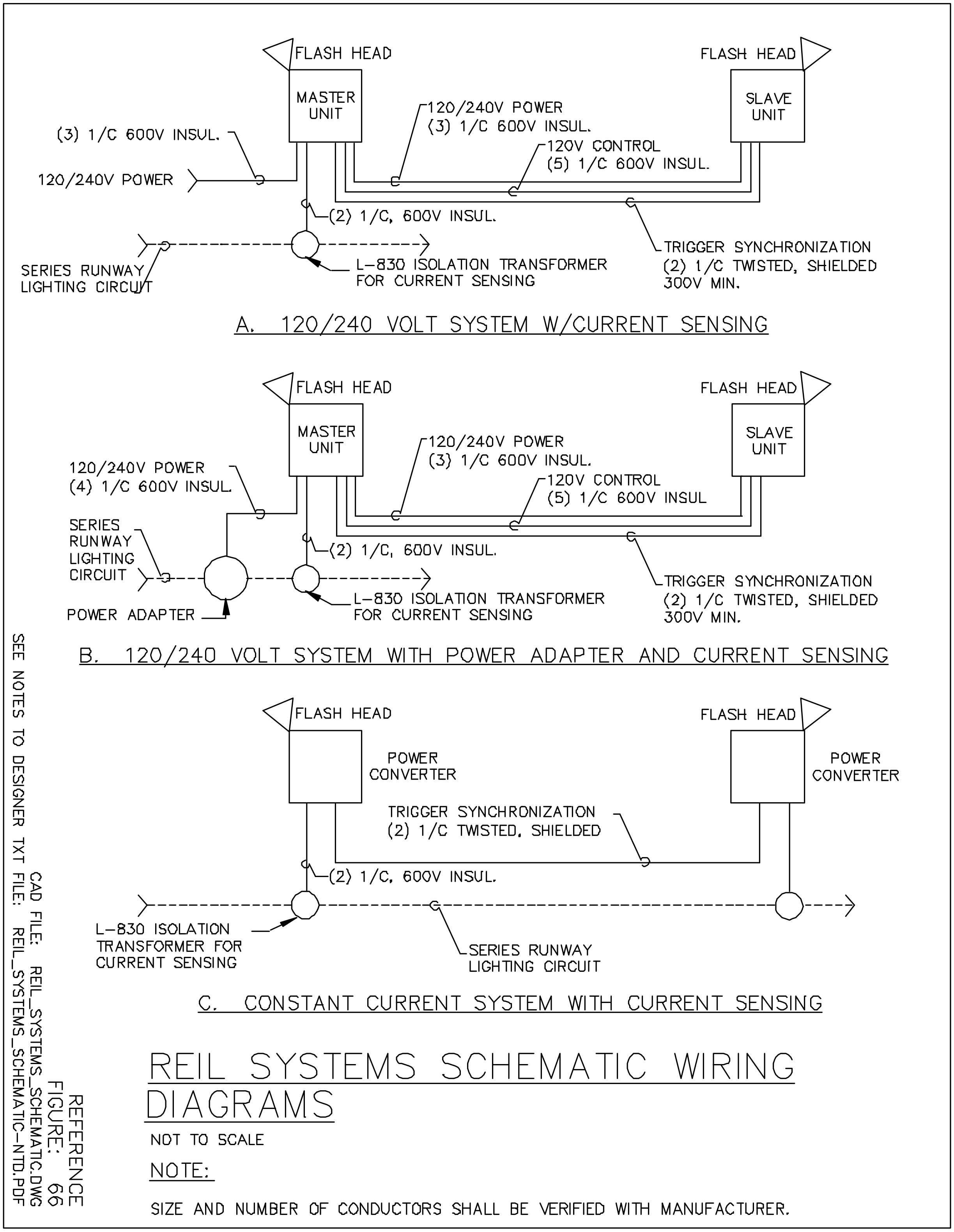


Figure 66. REIL Systems Schematic Wiring Diagrams

5.7. REIL Installation Details

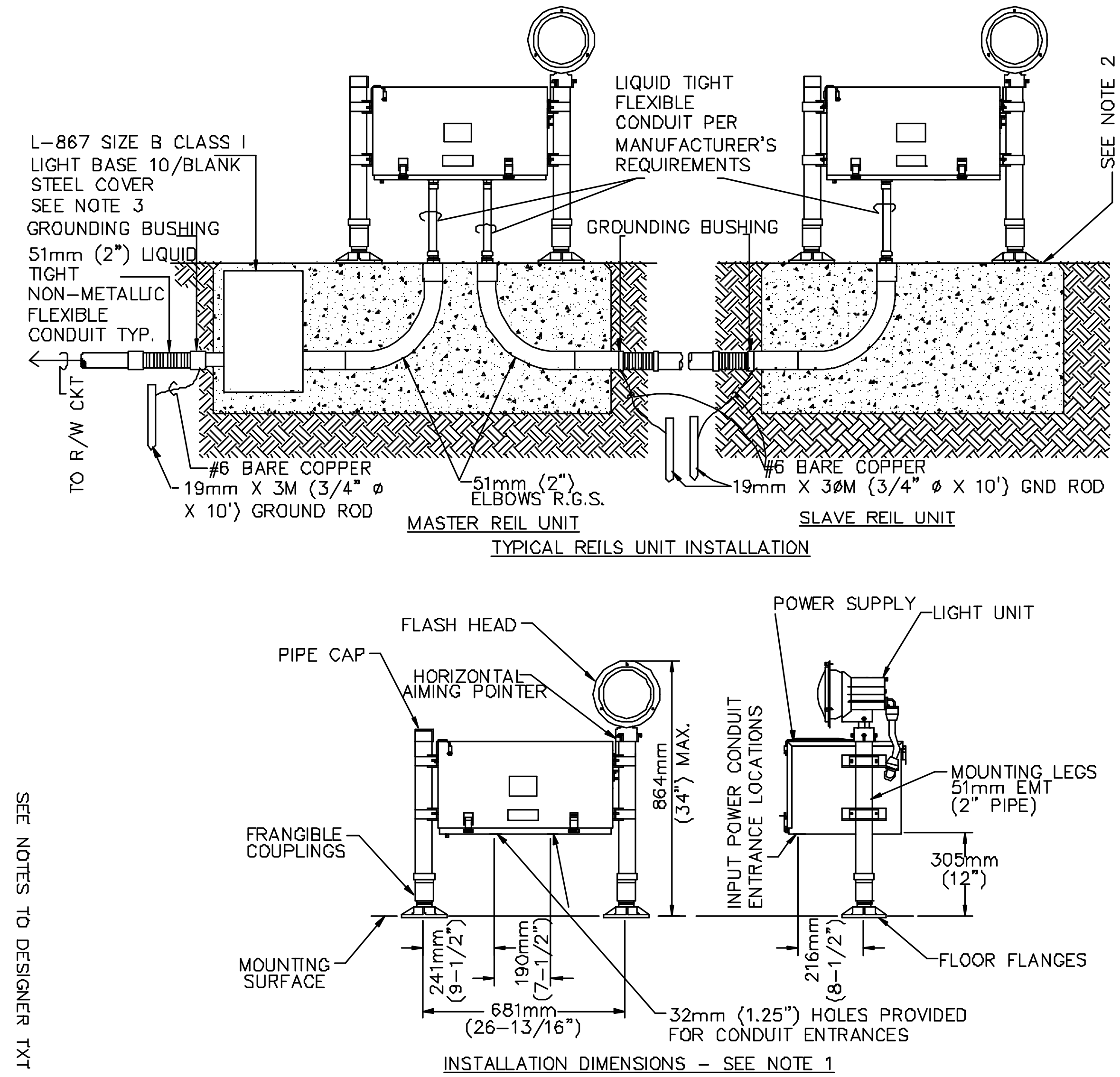
See figure 67.

Notes to Designer:

1. This detail shows a 120/240 volt system installation. These units are manufactured by Crouse-Hinds. Other manufacturers are similar but arrangements of conduit entrances and support legs may be different. Recommend verifying requirements with several different manufacturers.

2. Foundations will vary with manufacturer.

3. Ensure contract documents show location of REILs and power source. Locations will be as specified in Volume I.



REIL INSTALLATION DETAILS

NOT TO SCALE

NOTES:

1. DIMENSIONS AND LAYOUT VARY WITH MANUFACTURER. INSTALLATION SHALL BE PER MANUFACTURER'S REQUIREMENTS.
2. DIMENSION OF CONCRETE FOUNDATION VARIES WITH EQUIPMENT SUPPLIED. DEPTH SHALL BE 914mm (36") OR 152mm (6") BELOW FROST LINE WHICHEVER IS GREATER.
3. L-867 BASE FOR MOUNTING L-830 ISOLATION TRANSFORMER MAY BE PART OF FOUNDATION OR MOUNTED SEPARATELY.
4. WIRING SHALL BE PER MANUFACTURER'S REQUIREMENTS.
5. INCOMING POWER WIRING AND CONDUIT NOT SHOWN FOR CLARITY. POWER WIRING MAY ENTER L-867 LIGHT BASE IN A SEPARATE CONDUIT FROM THE SERIES CIRCUIT LIGHTING CABLES.

Figure 67. REIL Installation Details

Chapter 6: MISCELLANEOUS (ROTATING BEACONS, WIND CONES, CAN PLAZAS, MANHOLES, AND HIGH MAST LIGHTING)

6.1. 15.5M (51’) Pre-fabricated Beacon Tower

See figure 68.

Notes to Designer:

1. This diagram shows a typical self-supporting 51 foot tower. Actual height of tower will depend on site conditions. Refer to Volume I for additional information.

2. Tower is designed by manufacturer. Recommend furnishing manufacturer with following data based on actual site:

   a. Weight and EPA of proposed beacon

   b. Beacon mounting footprint

   c. Overall height of tower

   d. Soil bearing capacity and analysis based on borings taken at site.

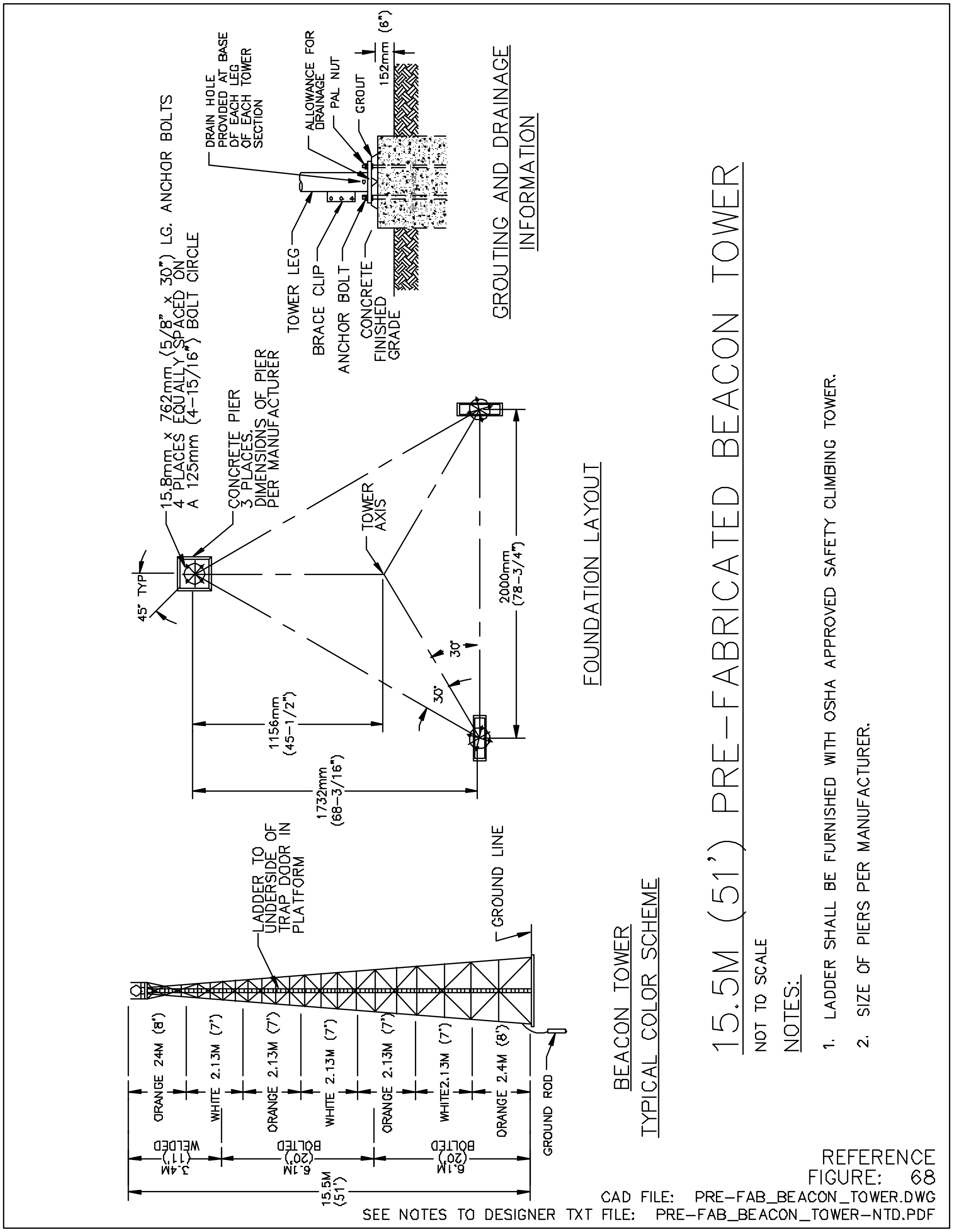


Figure 68. 15.5M (51') Pre-fabricated Beacon Tower

6.2. Beacon Dimensions and Wiring Diagram

See figure 69.

Notes to Designer:

1. The dimensions may vary between manufacturers.

2. Control of the beacon is typically automatic by a photocell or timeclock. Means should be provided in the control tower for overriding the photocell or timeclock. The beacon could be located up to 5000’ from the nearest runway and power wiring will come from the closest source. The control feed from the tower override could be by radio link, telephone switching relay, etc. Recommend during design that control route and available power be verified.

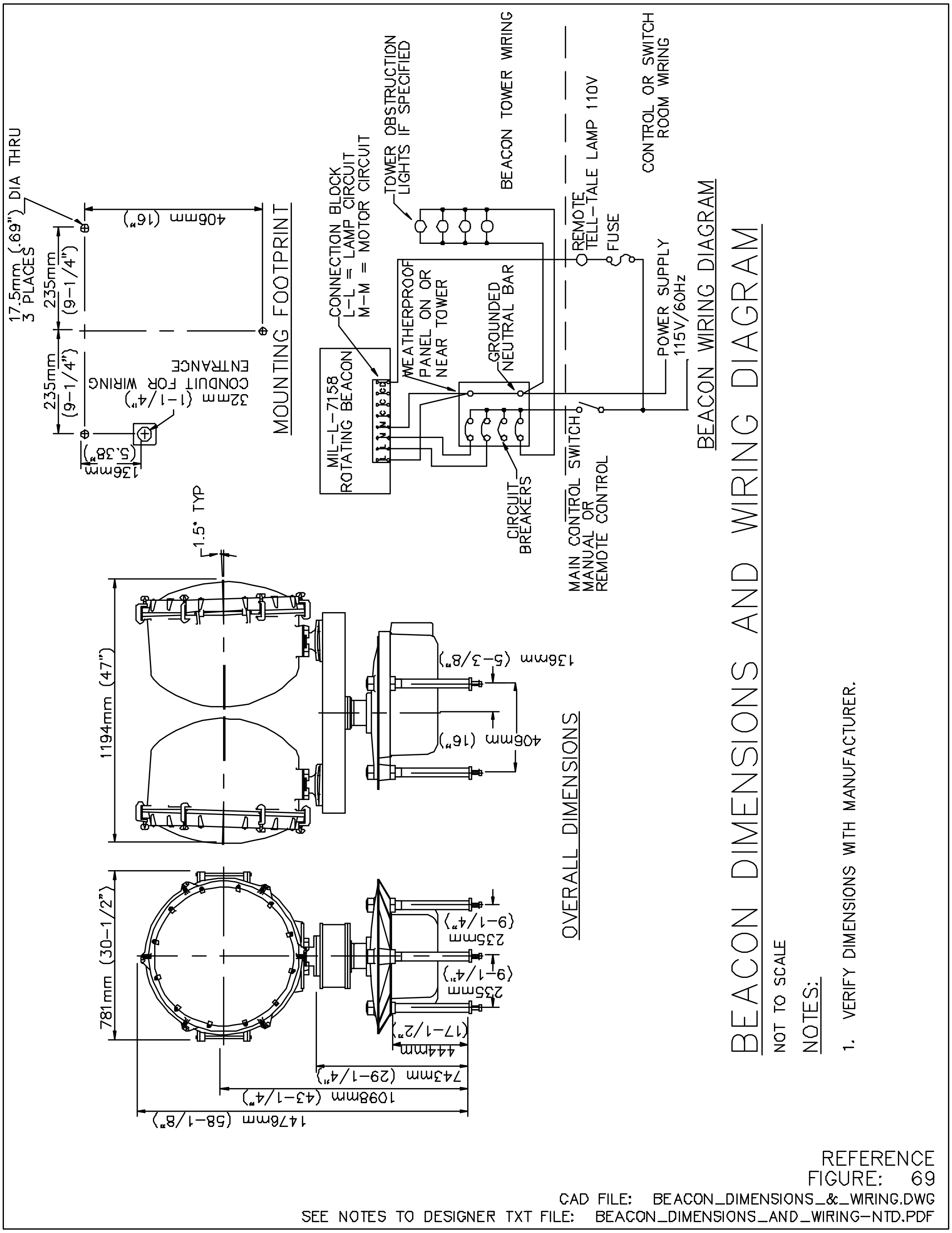


Figure 69. Beacon Dimensions and Wiring Diagram

6.3. Beacon Tower Platform Details

See figure 70.

Notes to Designer:

Figure is self-explanatory.

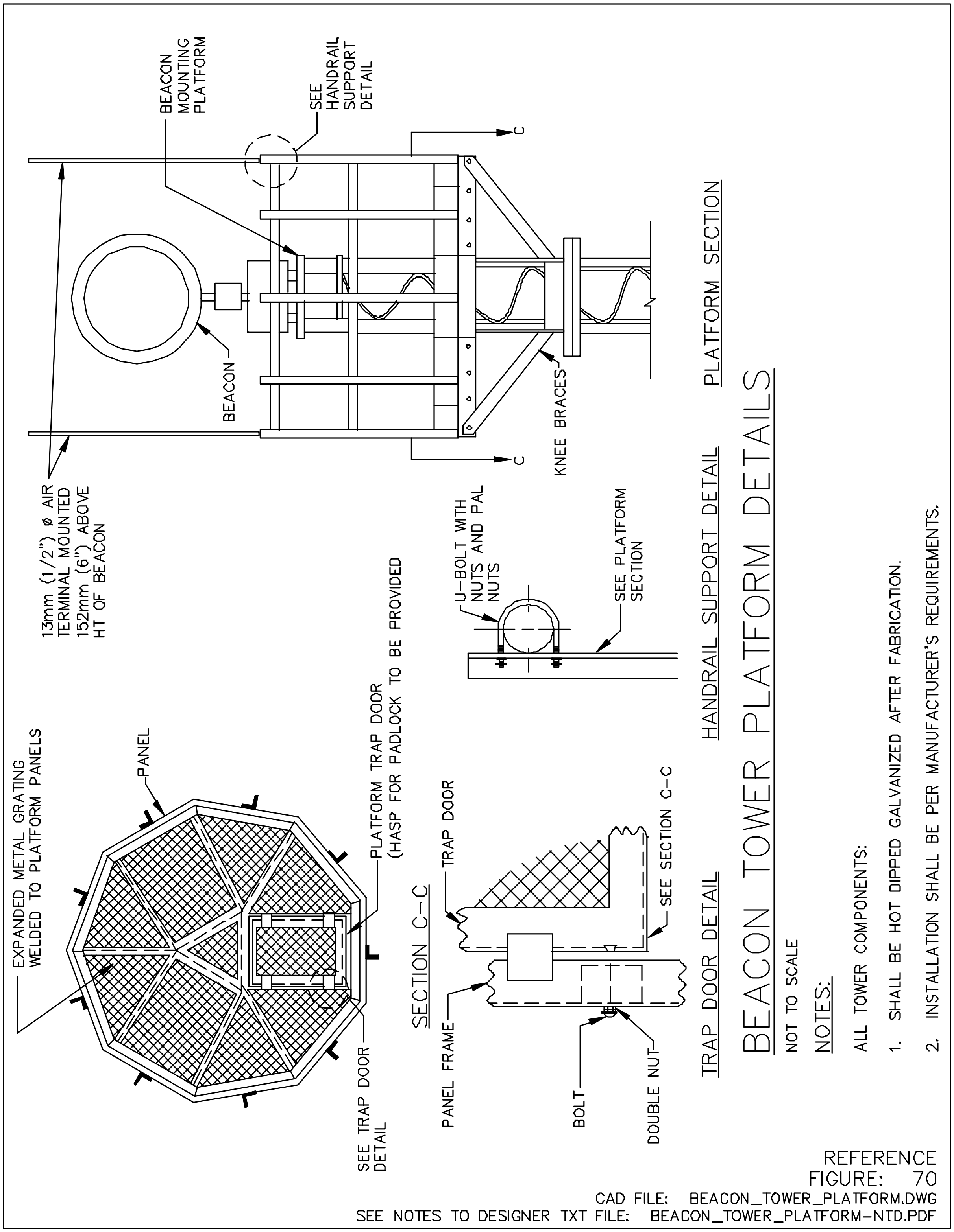


Figure 70. Beacon Tower Platform Details

6.4. Tower Safety Climbing Device

See figure 71.

Notes to Designer:

Figure is self-explanatory.

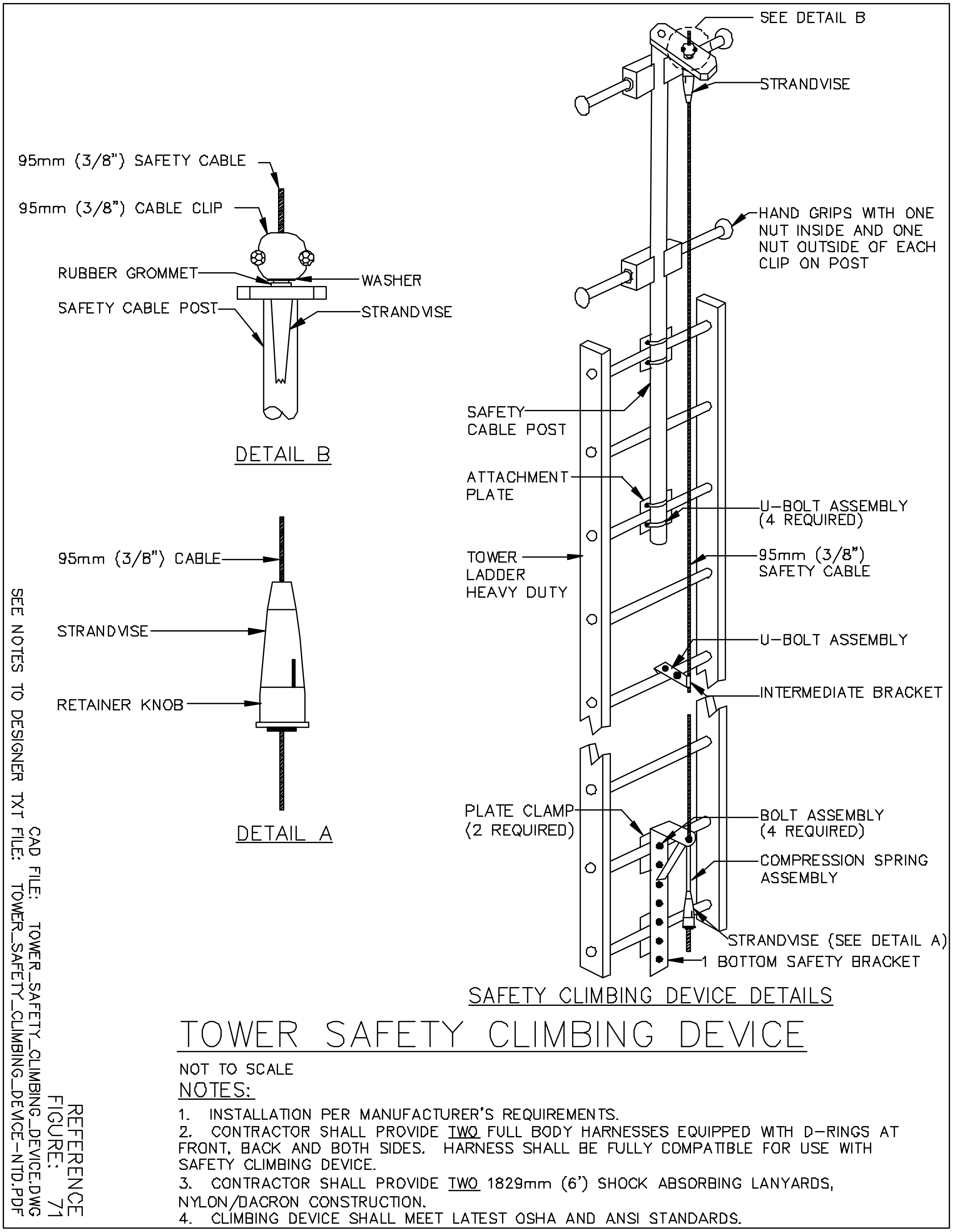


Figure 71. Tower Safety Climbing Device

6.5. L-806 Windcone Assembly (Frangible)

See figure 72.

Notes to Designer:

1. Typically, windcones are powered from a 120 volt source. Voltage drop must be analyzed. Depending on the length of run, a boosting transformer may have to be added.

2. The windcone may be powered from the runway lighting circuit either by using a power adapter to provide 120 volt source or using 6.6 amp lamps and isolation transformers. In either case, the illumination of the windcone may not vary more than 20% from the value specified in Volume I when the runway lighting circuit is at its lowest brightness step.

3. If power is to be provided by a power adapter, consult with manufacturer of power adapter and regulator. Power adapters often have varied performance. Variations in brightness levels selected, load, and regulators will produce variations in voltage output.

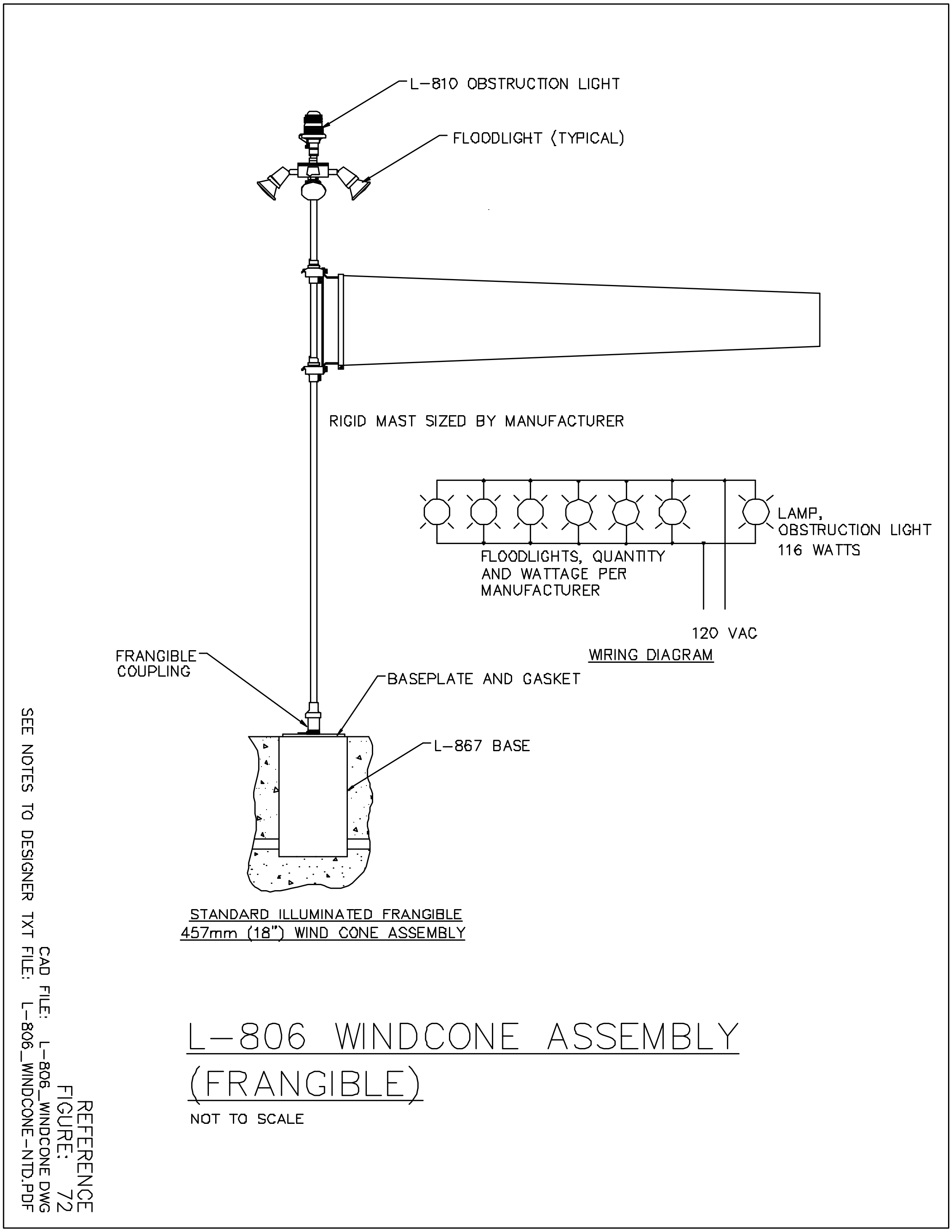


Figure 72. L-806 Windcone Assembly (Frangible)

6.6. L-807 Windcone Assembly (Rigid Installation)

See figure 73.

Notes to Designer:

1. Typically, windcones are powered from a 120 volt source. Voltage drop must be analyzed. Depending on the length of run, a boosting transformer may have to be added.

2. The windcone may be powered from the runway lighting circuit either by using a power adapter to provide 120 volt source or using 6.6 amp lamps and isolation transformers. In either case, the illumination of the windcone may not vary more than 20% from the value specified in Volume I when the runway lighting circuit is at its lowest brightness step.

3. If power is to be provided by a power adapter, consult with manufacturer of power adapter and regulator. Power adapters often have varied performance. Variations in brightness levels selected, load, and regulators will produce variations in voltage output.

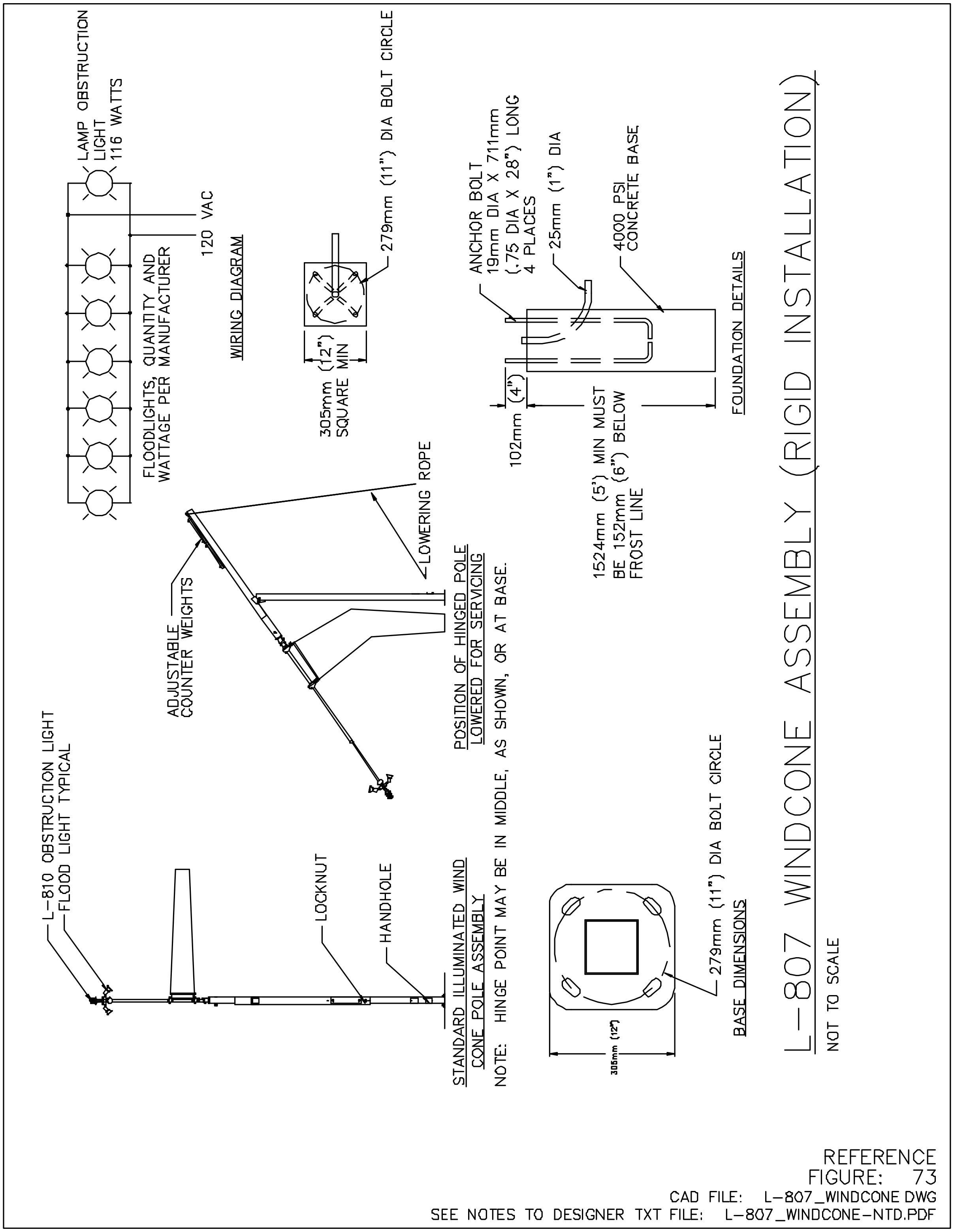


Figure 73. L-807 Windcone Assembly (Rigid Installation)

6.7. Junction Can Plaza, Type A (Air Force Only)

See figure 74.

Notes to Designer:

1. The junction can plaza is for Air Force installations only.

2. The purpose is to segregate the field circuits into separate conduit runs and provide access to each circuit. The advantages are:

   a. A fault in one circuit will not affect the other.

   b. Maintenance personnel do not have to be confined space trained (presently required by OSHA to enter manholes).

   c. Access time is considerably less than manholes.

3. Circuit and junction can plaza ID's should be indicated on the layout plans. The designer should coordinate with maintenance and operations personnel during the design review process to ensure each circuit and junction can is identified correctly for the specific installation.

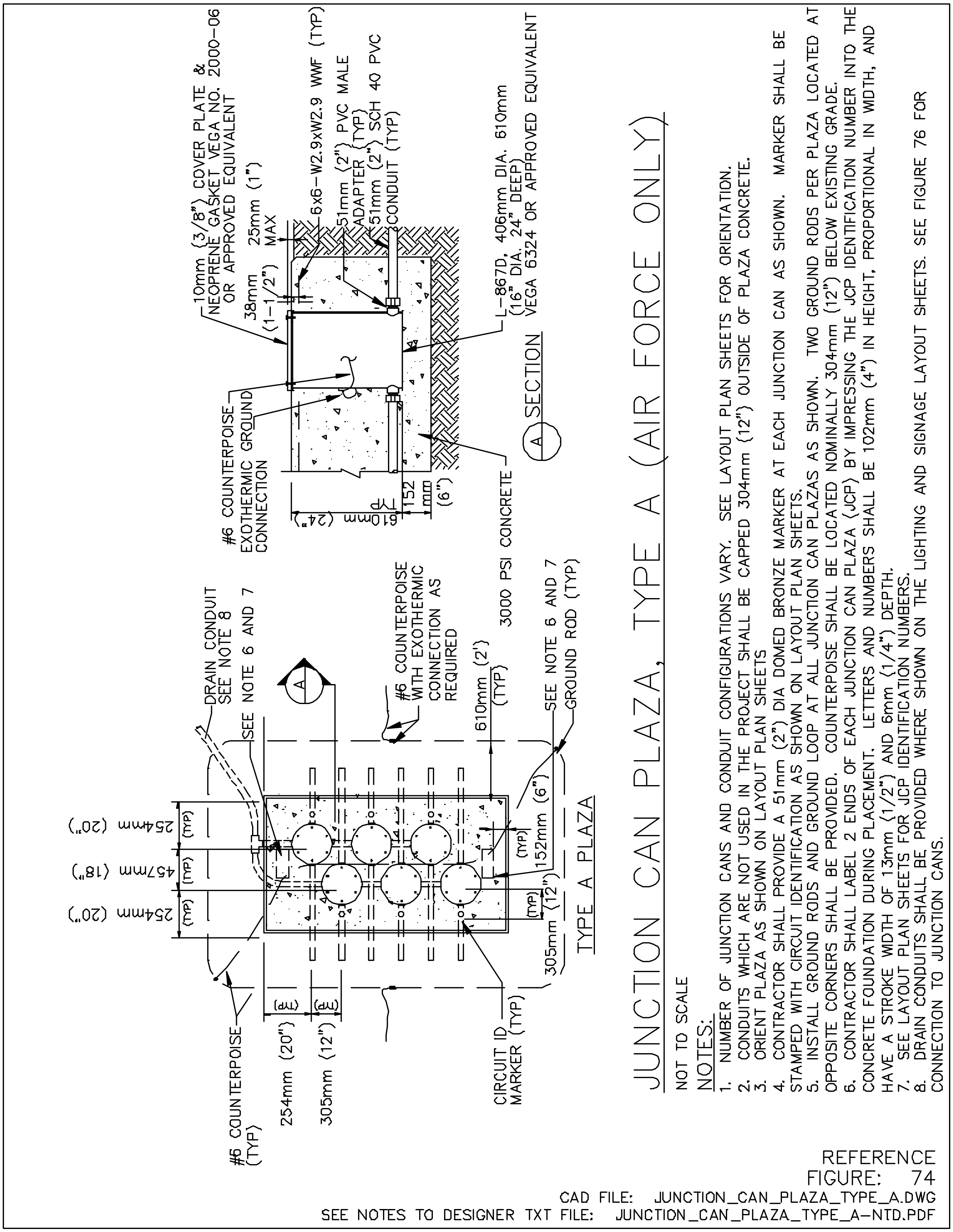


Figure 74. Junction Can Plaza, Type A (Air Force Only)

6.8. Junction Can Plaza, Type B (Air Force Only)

See figure 75.

Notes to Designer:

1. The junction can plaza is for Air Force installations only.

2. The purpose is to segregate the field circuits into separate conduit runs and provide access to each circuit. The advantages are:

    a. A fault in one circuit will not affect the other.

    b. Maintenance personnel do not have to be confined space trained (presently required by OSHA to enter manholes).

    c. Access time is considerably less than manholes.

3. Circuit and junction can plaza ID's should be indicated on the layout plans. The designer should coordinate with maintenance and operations personnel during the design review process to ensure each circuit and junction can is identified correctly for the specific installation.

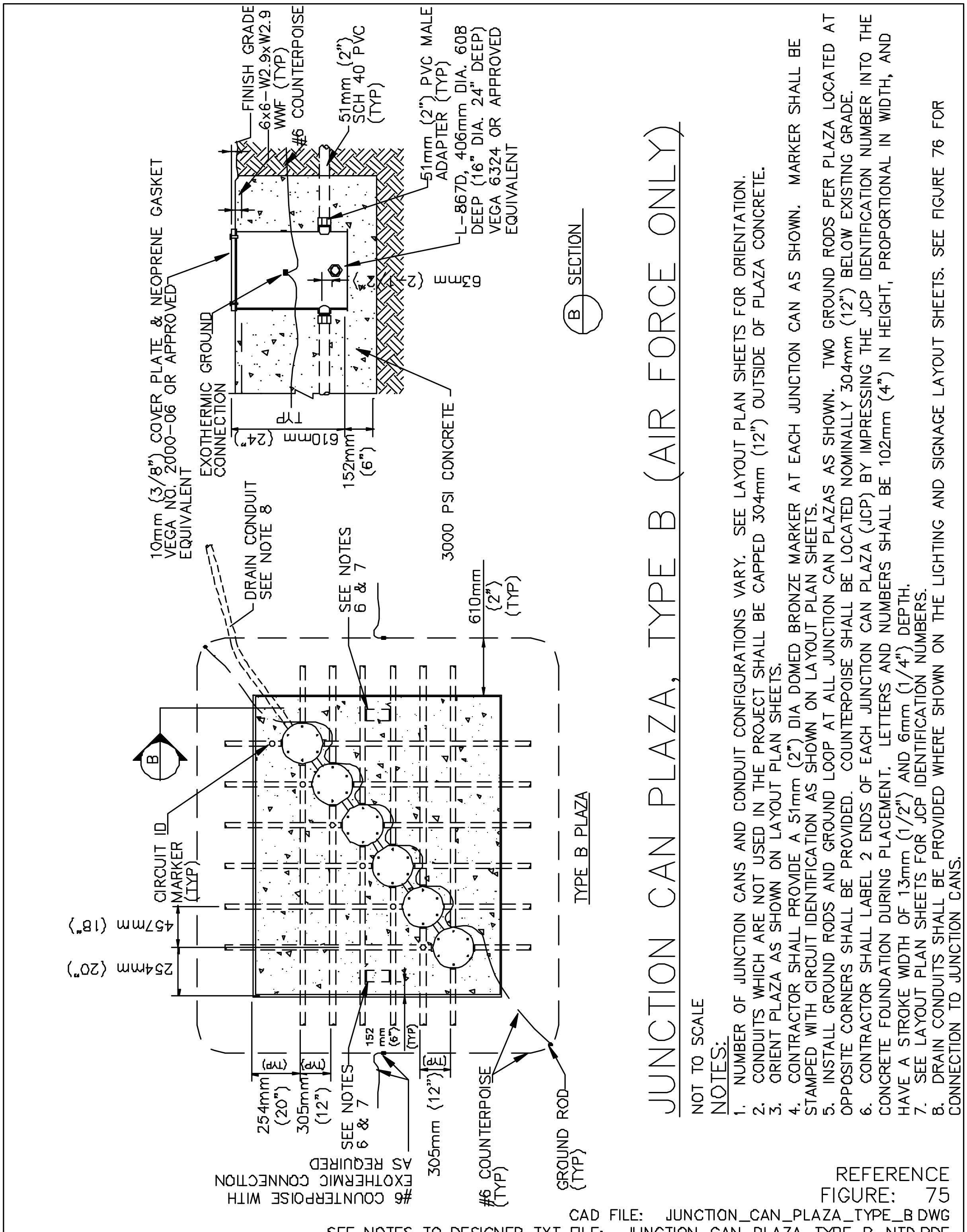


Figure 75. Junction Can Plaza, Type B (Air Force Only)

6.9. Drain for Junction Cans (Air Force Only)

See figure 76.

Notes to Designer:

1. The junction can plaza is for Air Force installations only.

2. The purpose is to segregate the field circuits into separate conduit runs and provide access to each circuit. The advantages are:

   a. A fault in one circuit will not affect the other.

   b. Maintenance personnel do not have to be confined space trained (presently required by OSHA to enter manholes).

   c. Access time is considerably less than manholes.

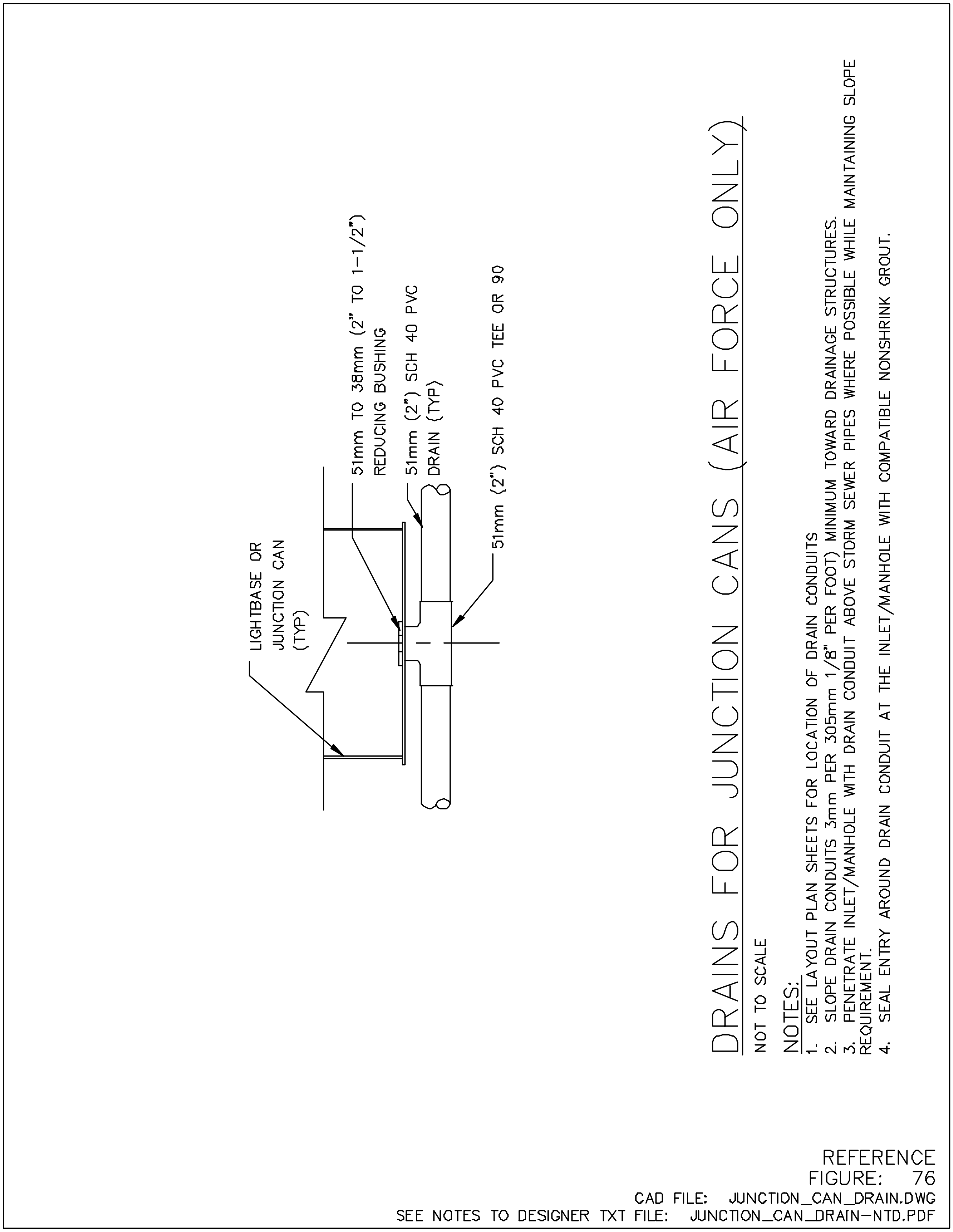


Figure 76. Drains for Junction Cans (Air Force Only)

6.10. Typical Precast Electrical Manhole Detail

See figure 77.

Notes to Designer:

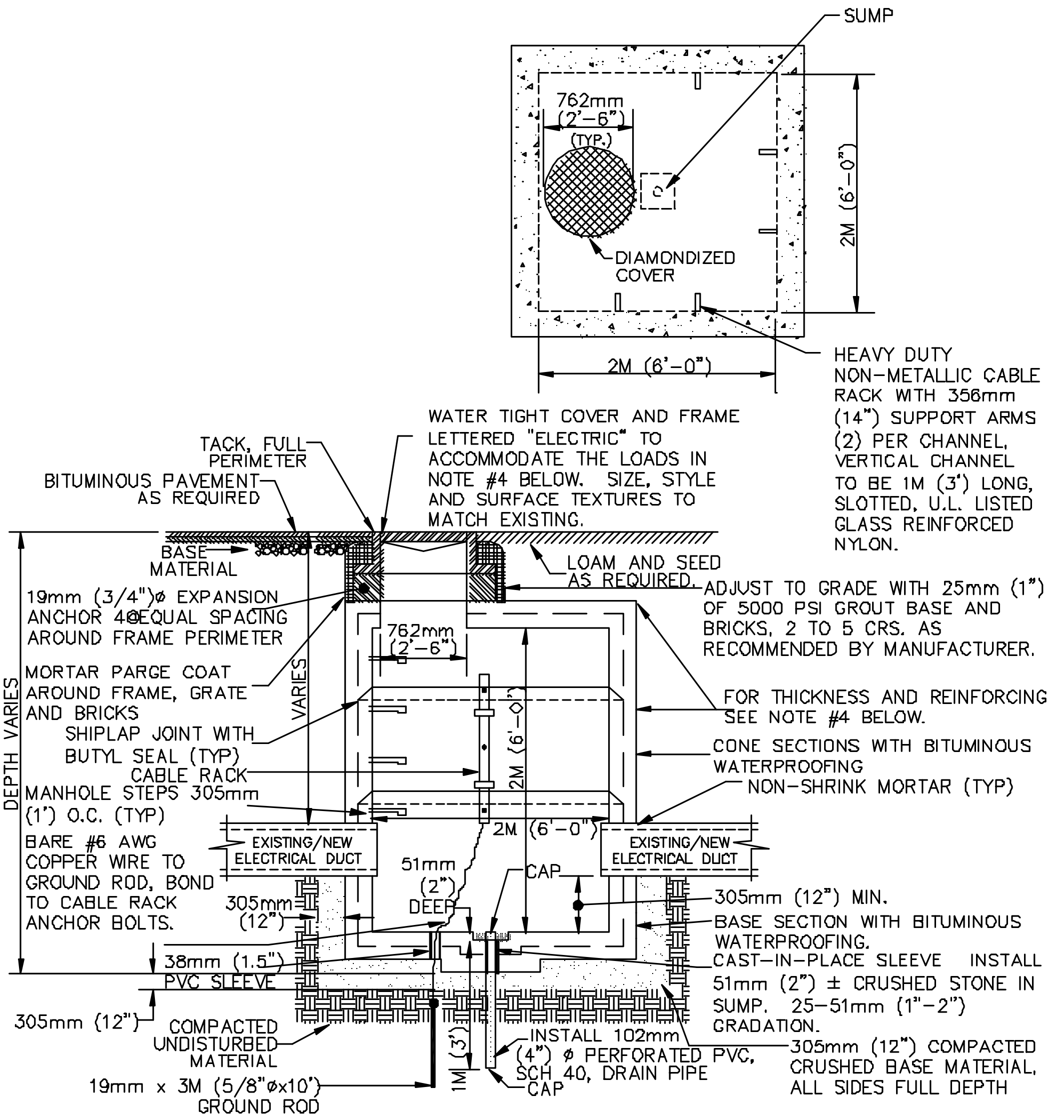
1. Dimensions and depth of manhole will vary with size and depth of duct bank.

2. Locate manholes outside of runway and taxiway safety areas wherever possible.

3. This manhole was designed for a Boeing 727-200 (191,000 lbs.) aircraft, which is a typical design aircraft at most airports because of its wheel loading. Where heavier aircraft are anticipated, use the heavy duty manhole shown on Figures 78, 79 and 80.

4. The following table gives a comparison of the typical loadings for a Boeing727-200, KC10A and B-1B. The heavy duty manhole would be used for the KC-10A or B-1B design.

Aircraft	**Boeing 727-200**	**KC-10A**	**B-1B**
Max T/O Wt (kips)	209.5	590.0	477.0
Max. Gear Assembly Load (kips)	96.8	217.1	221.8
No. Wheels in Gear Assembly	2	4	4
Max. Single Wheel Load	48.4	54.3	55.5



TYPICAL PRECAST ELECTRICAL MANHOLE DETAIL

NOT TO SCALE

NOTES:

1. FRAMES AND GRATES SHALL BE PAINTED WITH TWO (2) COATS OF RUST RESISTANT, AVIATION YELLOW PAINT.
2. MANHOLE COVERS SHALL BE NUMBERED AS DIRECTED WITH BLACK PAINT. LETTERING SHALL BE 152mm (6") HIGH, BLOCK LETTERING.
3. THE INSIDE CONE OF ALL MANHOLES SHALL ALSO BE NUMBERED.
4. THICKNESS AND REINFORCING OF MANHOLE TOP, WALLS, AND FLOOR TO BE DESIGNED TO ACCOMMODATE A 191,000 POUND BOEING 727-200. CONCRETE TO BE 5000 PSI. @ 28 DAYS. STEEL TO BE ASTM A6150 GRADE 60, 60000 PSI.YIELD. MINIMUM WALL THICKNESS SHALL BE 127mm (5") MINIMUM TOP AND FLOOR THICKNESS SHALL BE 203mm (8"). FOR HEAVIER AIRCRAFT, SEE FIGURE 78.

SEE NOTES TO DESIGNER TXT FILE

CAD FILE: PRECAST_ELECTRICAL_MANHOLE.DWG
PRECAST_ELECTRICAL_MANHOLE-NTD.PDF

REFERENCE
FIGURE: 77

Figure 77. Typical Precast Electrical Manhole Detail

6.11. Heavy Duty Manhole Detail

See figures 78, 79 and 80.

Notes to Designer:

1. This manhole was designed for a B-1B aircraft which has one of the heaviest combined gear loading. Lateral loadings on the manhole were calculated using an equation from Spangler and Hardy, similar to the Boussinesq equations, but modified to account for the presence of a rigid structure (manhole) in the soil. The at-rest lateral Earth pressure coefficient was assumed to be 1.0 with a soil density of 130 pcf to give a conservative design.

2. For lighter aircraft, the precast manhole shown in Figure 77 could be used. The following table gives a comparison of the typical loadings for a Boeing 727-200, Kc-10A and B-1B.

Aircraft	**Boeing 727-200**	**KC-10A**	**B-1B**
Max T/O Wt (kips)	209.5	590.0	477.0
Max. Gear Assembly Load (kips)	96.8	217.1	221.8
No. Wheels in Gear Assembly	2	4	4
Max. Single Wheel Load	48.4	54.3	55.5

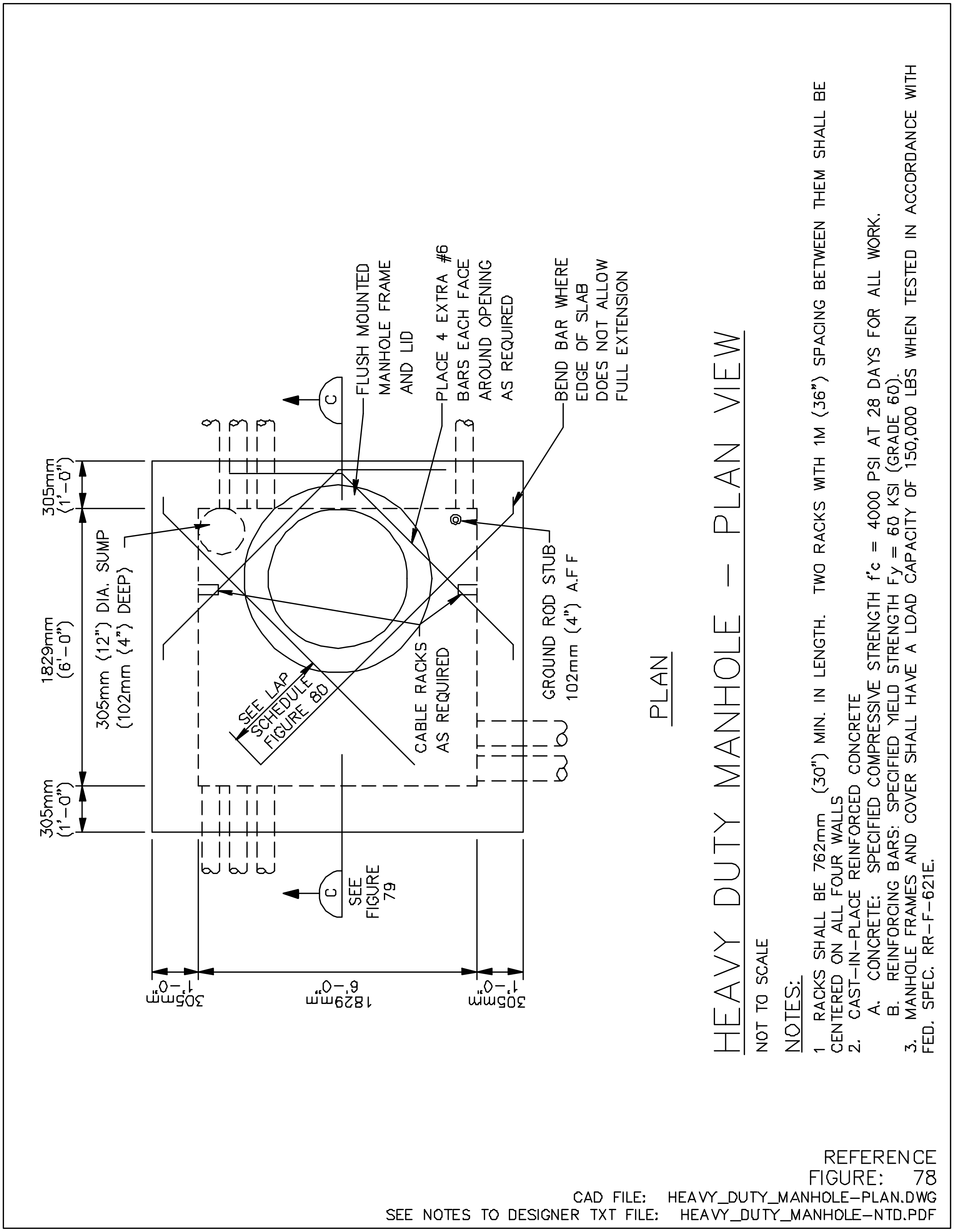


Figure 78. Heavy Duty Manhole – Plan View

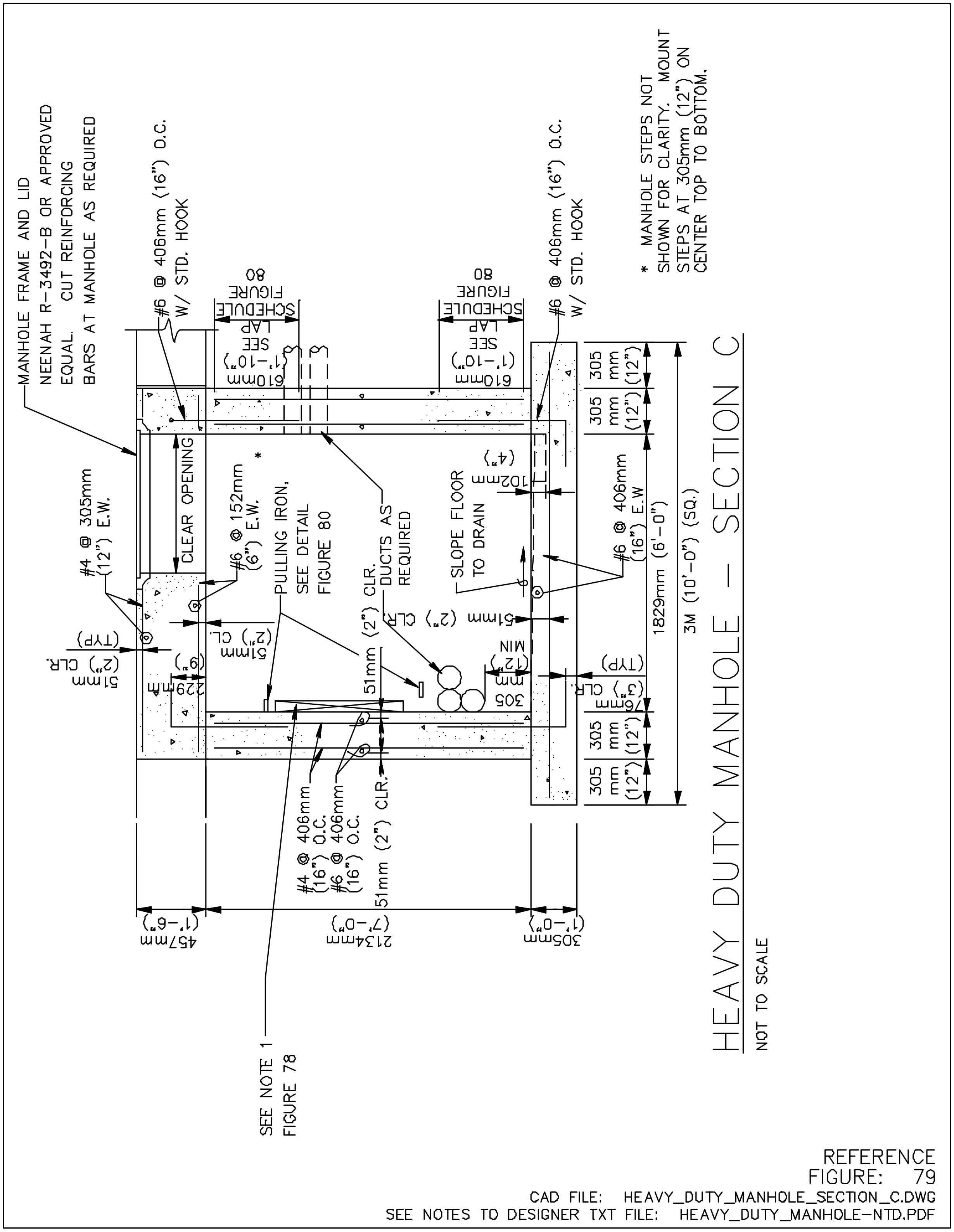


Figure 79. Heavy Duty Manhole – Section C

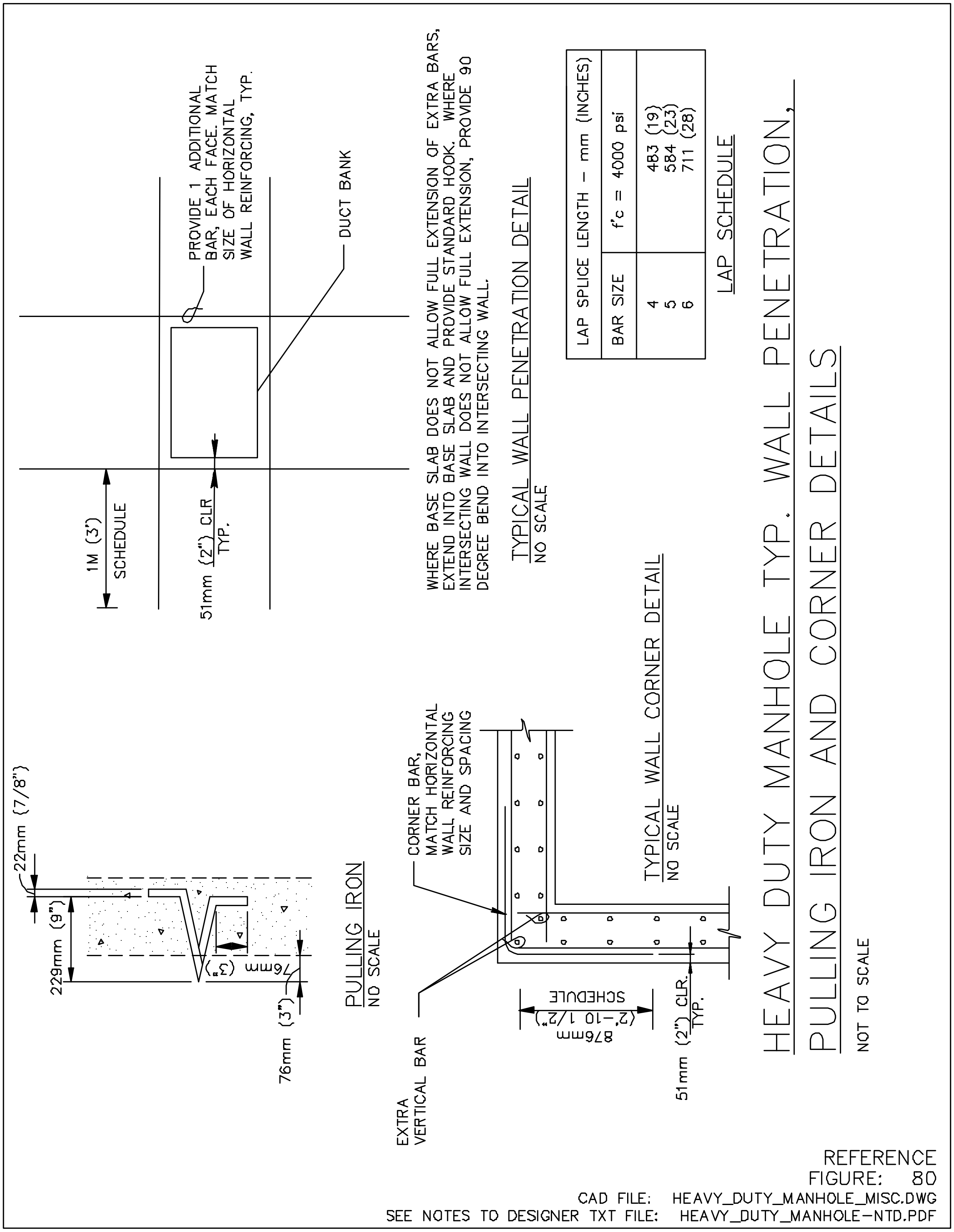


Figure 80. Heavy Duty Manhole – Typical Wall Penetration, Pulling Iron, & Corner Details

6.12. Typical High Mast Lighting Poles

See figure 81, 82, 83 and 84.

Notes to Designer:

1. High mast lighting is used to illuminate parking areas, aprons, etc. A lowering device is incorporated into the design to allow lowering of the fixtures for maintenance.

2. Several factors should be taken into account when designing a high mast lighting system, such as:

   a. Soil analysis type and bearing capacity,

   b. EPA of fixtures,

   c. Line of sight clearance from control tower, and

   d. Required illumination levels at grade.

3. The following are suggested specifications:

   a. High Mast Lighting Poles. Poles shall be in accordance with the requirements of the "Standard Specification For Structural Supports For Highway Signs; Luminaires, And Traffic Signals", 1994 edition (published by American Assoc. Of State Highway And Transportation Officials) as applicable. Specific requirements are as follows:

      (1) Shafts. Shaft sections shall be slip jointed, and joint length shall be a minimum of 1-1/2 times the inside diameter at the bottom of the female section. Shaft sections shall form a tight fit at joined sections. The shaft cross section may be round or multi-sided tapered steel tubes (8 sides minimum).

      (2) Bases. Each base shall be made of the steel specified for the shaft and shall be designed to withstand the full bending moment and shear of the shaft. Supplementary reinforcing shall be provided around the handhole area.

   b. Provide a Holophane LD5 lowering device, consisting of headframe, lowering ring, winch, and drill motor or an approved equal system. See details of the Holophane system on figures 82, 83, and 84 and in specifications.

   c. Finish requirements. Finish shall be galvanizing. Galvanizing shall conform ASTM A 123.

   d. Welding. All welding shall be performed by welders certified in accordance with the requirements of AWS D1.1-96.

e. Basic requirements:

(1) General. The end product is to be a fully coordinated, well-engineered installation. The selection of materials and major components such as the pole, headframe assembly, floodlight mounting assembly as well as installation and interface techniques are to be such as to produce this result.

f. Pole design requirements. The installation shall be designed in accordance with AASHTO LTS-3 for 80 mph wind velocities. The E.P.A. of the 1000 watt HPS fixtures is approx. 2.8 sq. feet each. The weight approx. 63 lbs. each. The total EPA of the cross arms is approx. 3.45 sq. feet each, and the total weight is approximately 50 lbs. The contractor must use E.P.A. and weights of the actual fixtures to be installed in his calculations.

g. Foundation requirements:

(1) Allowable loads shall not exceed those shown. If actual loads exceed those shown, the contractor shall be responsible for required foundation redesign. The pole supplier shall submit foundation loads for review and approval.

(2) Anchor bolt design shall be coordinated between the pole supplier and the primary contractor. Anchor bolt design shall be submitted for review and approval.

(3) Concrete: shall be type V, sulfate resistant concrete with a specified compressive strength F'c = 4000 PSI at 28 days.

(4) Reinforcing bars: specified yield strength FY = 60 KSI (grade 60).

2. Foundation diameters are usually controlled by the geometry of the base plate. The bolt circle is expected to be 24” for this installation with a pole height of 80 feet and foundation depth of 15 feet. With a cover of 5d for the bolts, the minimum pier diameter is about 39 inches. A diameter of 42 inches is shown on the drawings to allow for manufacturer variation.

3. Wind loads are per AASHTO LTS-3.

4. Piers are designed using equations from the UBC for lateral loads on foundations employing lateral bearing.

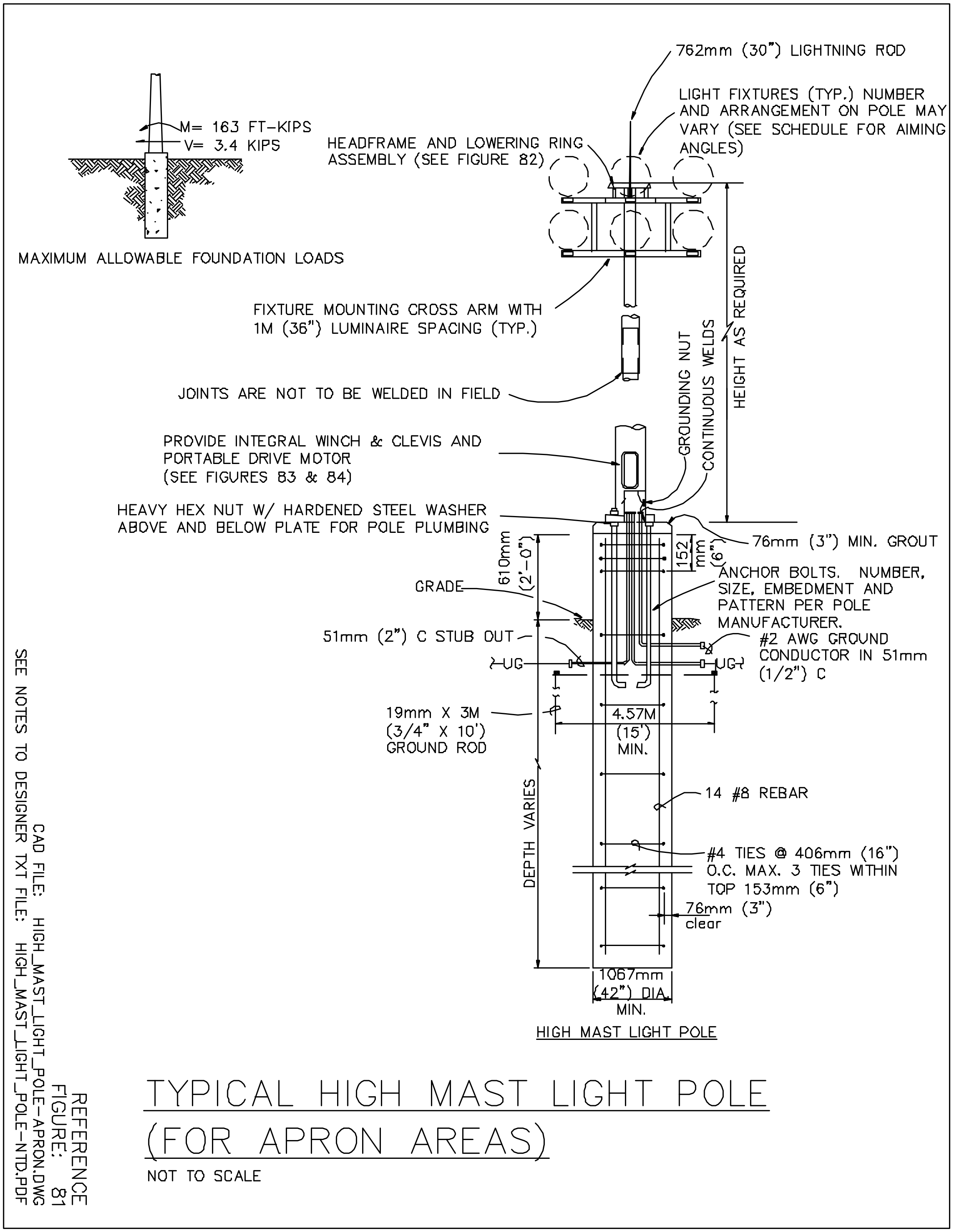
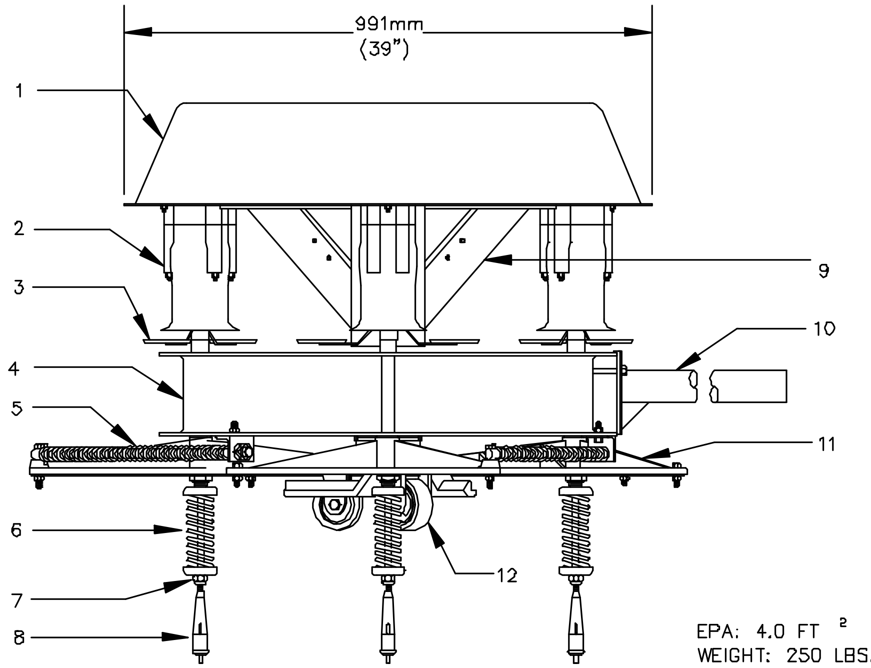


Figure 81. Typical High Mast Lighting Poles (for Apron Areas)



ITEM DESCRIPTIONS

1. SPUN COPPER FREE ALUMINUM COVER
2. CAST HIGH STRENGTH COPPER FREE ALUMINUM LATCH BARREL
3. RETRO-REFLECTING LATCH INDICATOR
4. HOT DIP GALVANIZED MOUNTING RING
   151mm X 51mm X 7GA FORMED STEEL CHANNEL
   (6" X 2" X 7GA FORMED STEEL CHANNEL)
5. STAINLESS STEEL CENTERING SPRING
6. STAINLESS STEEL COMPENSATING SPRING
7. STAINLESS STEEL ADJUSTMENT NUT
8. STRANVISE WIRE ROPE GRIP
9. HOT DIP GALVANIZED HEADFRAME
   FOR 118mm TO 121mm (4.63" TO 4.75") O.D. POLE TENON
10. LUMINAIRE MOUNTING ARM
    51mm (2") SCH. 40 PIPE, GALVANIZED
11. CAST ALUMINUM IRIS GUIDE ARMS
12. NON MARKING GUIDE ARM ROLLERS

HEAD FRAME AND LOWERING RING ASSEMBLY (TOP LATCH TYPE)

HIGH MAST LIGHT POLE HEAD FRAME AND LOWERING RING

NOT TO SCALE

REFERENCE FIGURE: 82
CAD FILE: HIGH_MAST_LIGHT_POLE_HEAD_FRAME.DWG
SEE NOTES TO DESIGNER TXT FILE: HIGH_MAST_LIGHT_POLE-NTD.PDF

Figure 82. High Mast Light Pole Head Frame and Lowering Ring

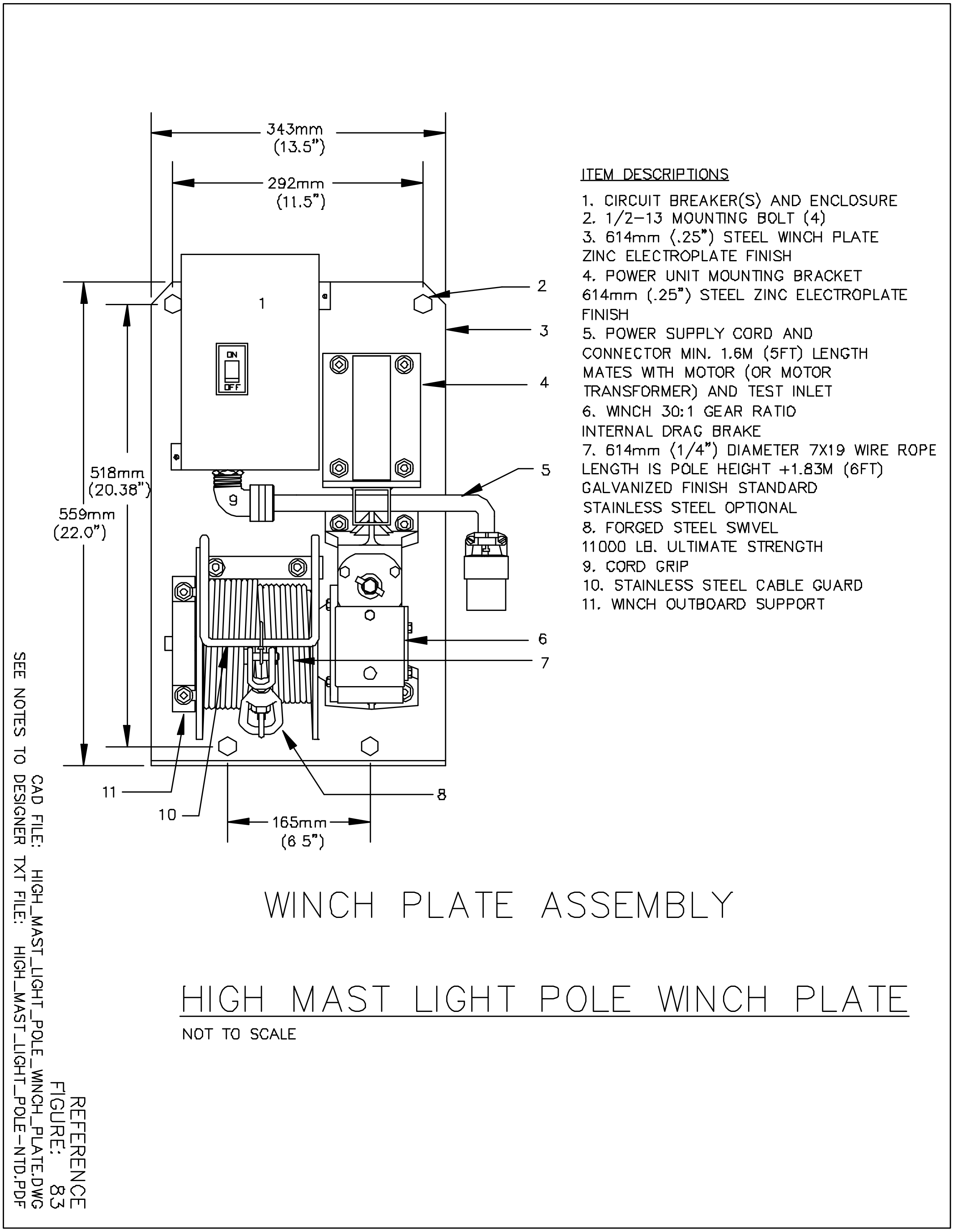
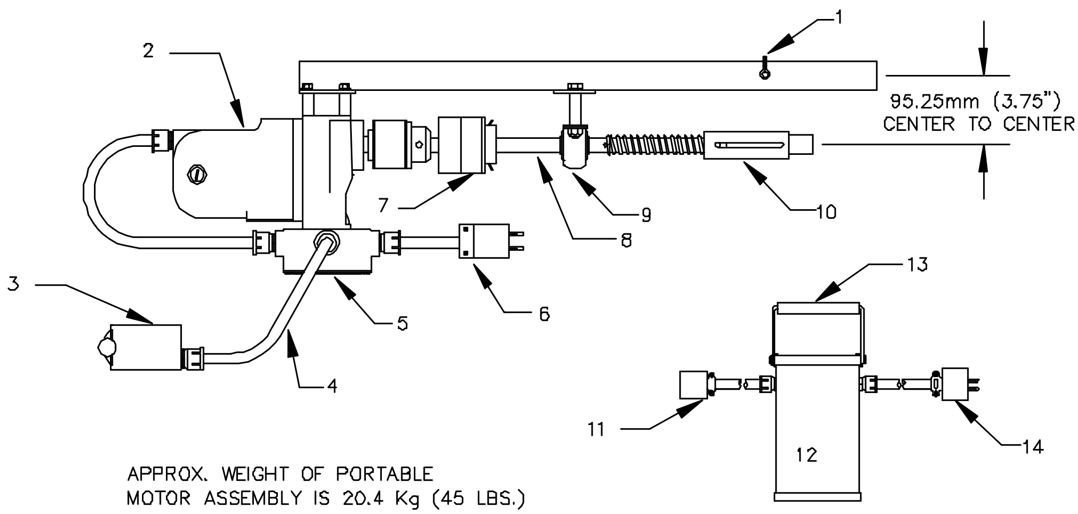


Figure 83. High Mast Light Pole Winch Plate



APPROX. WEIGHT OF PORTABLE
MOTOR ASSEMBLY IS 20.4 Kg (45 LBS.)
STEPDOWN TRANSFORMER IS
APPROX. 11.3 Kg (25 LBS.)

ITEM DESCRIPTION

1. HITCH PIN
2. 19mm (3/4") REVERSIBLE ELECTRIC MOTOR 120 VOLTS, 11.5 AMP 350 RPM 1 HP
3. REVERSING DRUM SWITCH
4. CONTROL CORD 6M (20FT) LENGTH
5. WIRING HOUSING
6. PLUG TO MATE TO CONNECTOR IN POLE BASE OR TRANSFORMER SECONDARY
7. TORQUE LIMITER COUPLING
8. 19mm (3/4") STEEL SHAFT
9. BALLBEARING PILLOWBLOCK
10. 16mm (5/8") HEX SOCKET CRANK SHAFT COUPLING
11. CONNECTOR TO MOTOR FROM 120V TRANSFORMER SECONDARY
12. STEPDOWN TRANSFORMER 120V SECONDARY 1.5 KVA FOR 240V, 277V, 480V, 600V 2.0 KVA FOR 208V
13. 51mm (1/2") CARRY HANDLE
14. PLUG TO CONNECTOR IN POLE BASE FROM TRANSFORMER PRIMARY

PORTABLE MOTOR ASSEMBLY

HIGH MAST LIGHT POLE PORTABLE MOTOR ASSEMBLIES

NOT TO SCALE

REFERENCE
FIGURE: 84
CAD FILE: HIGH_MAST_LIGHT_POLE_PORTABLE_MOTOR.DWG
SEE NOTES TO DESIGNER TXT FILE: HIGH_MAST_LIGHT_POLE-NTD.PDF

Figure 84. High Mast Light Pole Portable Motor Assemblies

Chapter 7: HELICOPTER PAD SYSTEMS

7.1. Helipad Perimeter Lighting

See figure 85.

Notes to Designer:

1. The standard elevated fixture is an FAA type L-861 base mounted with 45 watt lamp. The maximum height is 356mm (14”) above grade except in areas where snow accumulations of 305mm (12”) or more are frequent, the mounting height may be increased to 610mm (24”) above grade.

2. In areas that are paved and used by wheeled helicopters or vehicles semiflush fixtures are used and are FAA type L-852E base mounted fixtures.

3. The perimeter lights are normally powered from a constant current regulator with a minimum of 3 brightness steps. However, some installations may utilize constant voltage circuits (120/240V) such as helipads on rooftops and/or hospitals.

4. The series circuit cable is FAA type L-824C #8 or #6 AWG depending on the output current of the regulator. 6.6 amp circuits use #8 and 20 amp circuits use #6.

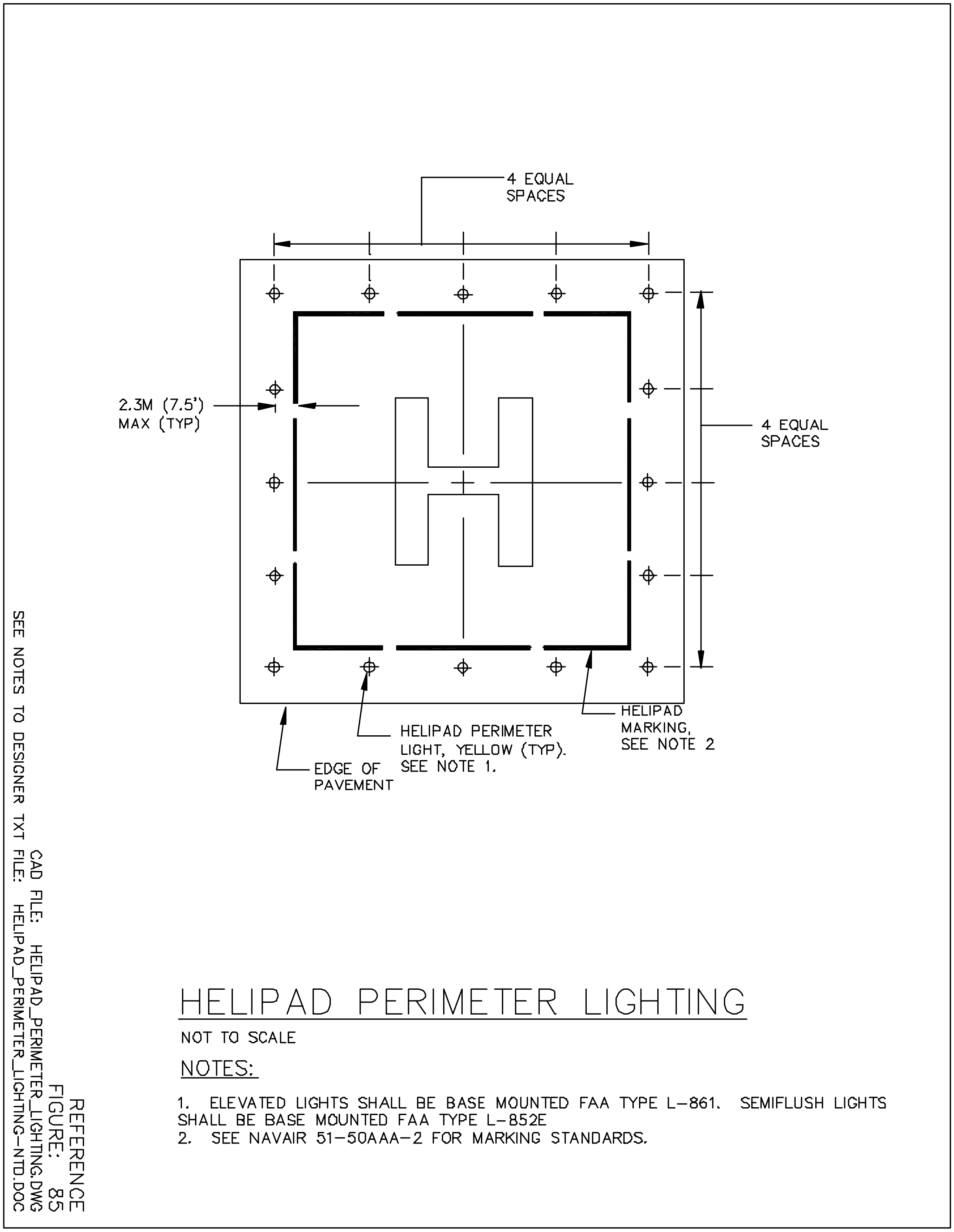


Figure 85. Helipad Perimeter Lighting

7.2. Hospital Helipad Perimeter Lighting

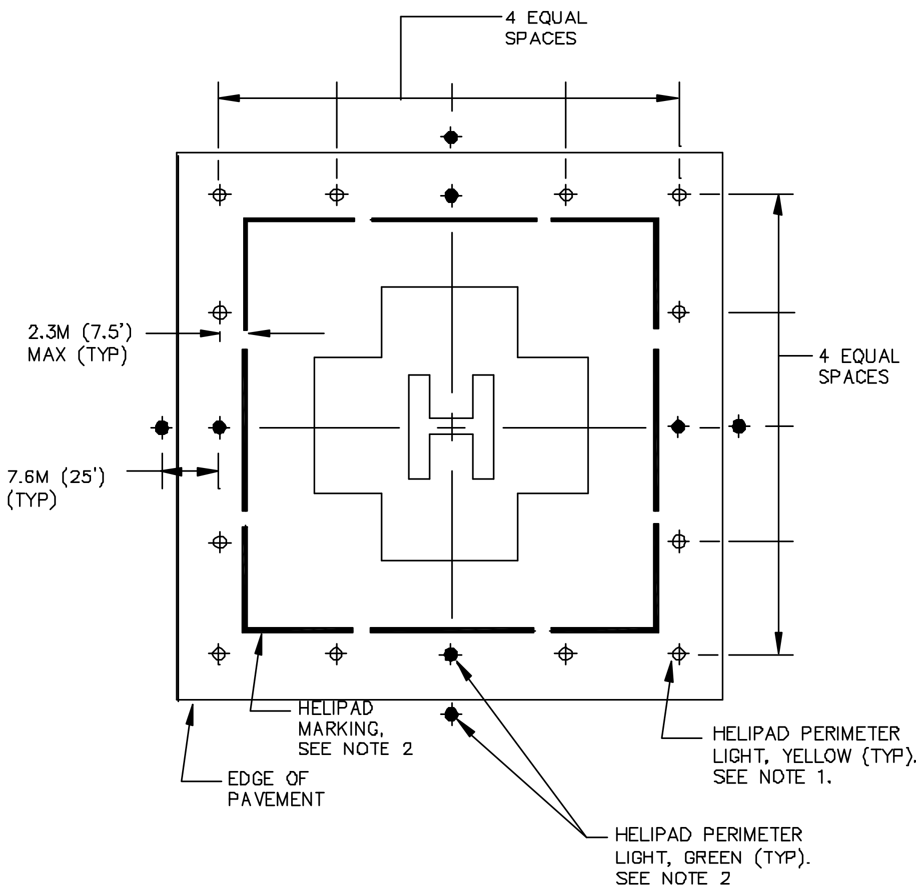
See figure 86.

Notes to Designer:

1. The hospital helipad perimeter light configuration is similar to the standard helipad light configuration except 4 additional lights are added. These lights are located 7.6M (25') from the middle light on each side of the helipad. These lights and the corresponding middle lights are green. The remaining perimeter lights yellow.

2. The color of lights for the hospital helipad should be coordinated with the user prior to design.

3. In areas where vehicle traffic will be crossing or accessing the helipad use semiflush fixtures.



HOSPITAL HELIPAD PERIMETER LIGHTING

NOT TO SCALE

NOTES:

1. ELEVATED LIGHTS SHALL BE BASE MOUNTED FAA TYPE L-861. SEMIFLUSH LIGHTS SHALL BE BASE MOUNTED FAA TYPE L-852E.
2. SEE NAVAIR 51-50AAA-2 FOR MARKING STANDARDS.

REFERENCE
FIGURE: 86
CAD FILE: HOSPITAL_HELIPAD_PERIMETER_LIGHTING.DWG
SEE NOTES TO DESIGNER TXT FILE: HOSPITAL_HELIPAD_PERIMETER_LIGHTING-NTD.DOC

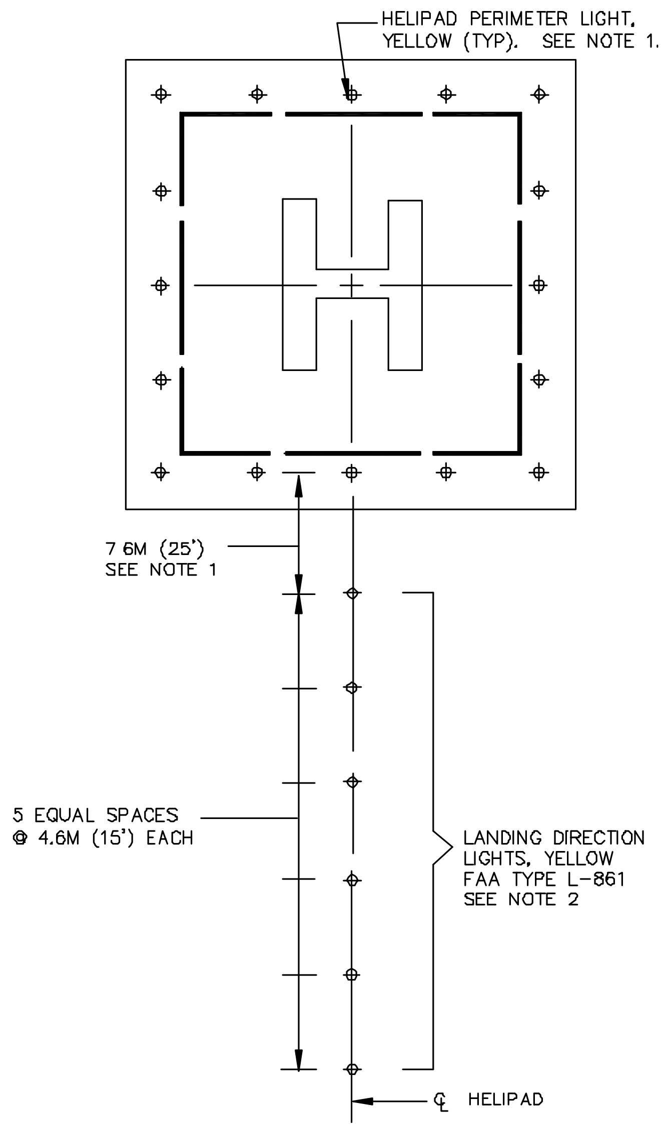
Figure 86. Hospital Helipad Perimeter Lighting

7.3. Helipad Landing Direction Lights

See figure 87.

Notes to Designer:

1. The landing direction lights may be powered from the same regulator feeding the perimeter lights. The circuit may be separated by using an FAA type L-847 circuit selector switch thereby allowing the direction lights to be switched off independently. The landing lights may not be switched on unless the perimeter lights are on.



HELIPAD LANDING DIRECTION LIGHTS

NOT TO SCALE

NOTES:

1. LANDING DIRECTION LIGHT CONFIGURATION FOR HOSPITAL HELIPAD SHALL START 7.6M (25') FROM THE OUTER PERIMETER LIGHT.
2. SEMIFLUSH FIXTURES SHALL BE USED IN AREAS OF VEHICLE TRAFFIC AND SHALL BE FAA TYPE L-852E

REFERENCE
FIGURE: 87
CAD FILE: HELIPAD_LANDING_DIRECTION_LIGHTS.DWG
SEE NOTES TO DESIGNER TXT FILE: HELIPAD_LANDING_DIRECTIONS_LIGHTS-NTD.DOC

Figure 87. Helipad Landing Direction Lights

7.4. Helipad Approach Direction Lights

See figure 88.

Notes to Designer:

1. The approach direction lights may be powered from the same regulator feeding the perimeter and landing direction lights. The circuits may be separated by using an FAA type L-847 circuit selector switch thereby allowing the approach direction lights to be switched off independently. The approach direction lights may not be switched on unless the perimeter and landing direction lights are on.

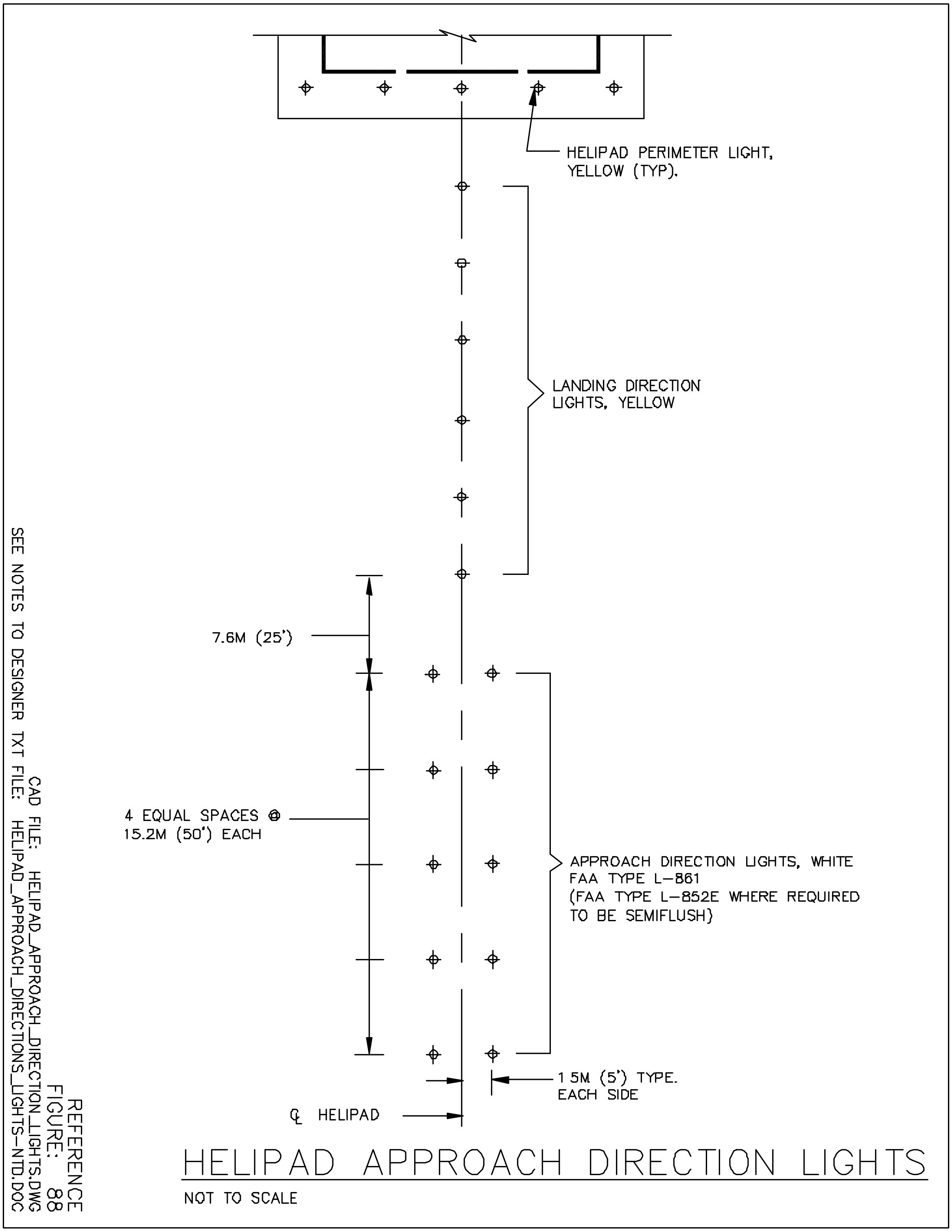


Figure 88. Helipad Approach Direction Lights

7.5. Helipad Lighting Wiring and Control Diagram

See figure 89.

Notes to Designer:

1. This figure shows a typical control diagram at a facility that has both an airfield lighting vault and control tower. A single constant current regulator with 3 brightness steps is used to power the system.

2. The helipad lights are separated into 3 circuits: C1 – perimeter, C2 – landing direction, and C3 – approach direction. Each circuit is operated by a SPST toggle switch that energizes the corresponding loop relay in the L-847 circuit selector switch. The 3 switches are connected such that the landing direction lights cannot be on unless the perimeter lights are on and the approach direction lights cannot be on unless the landing direction lights are on.

3. In some installations 120/240V is used to power the circuits in lieu of constant current regulators. In these cases separate branch circuits are used together with lighting contactors and interlock switches.

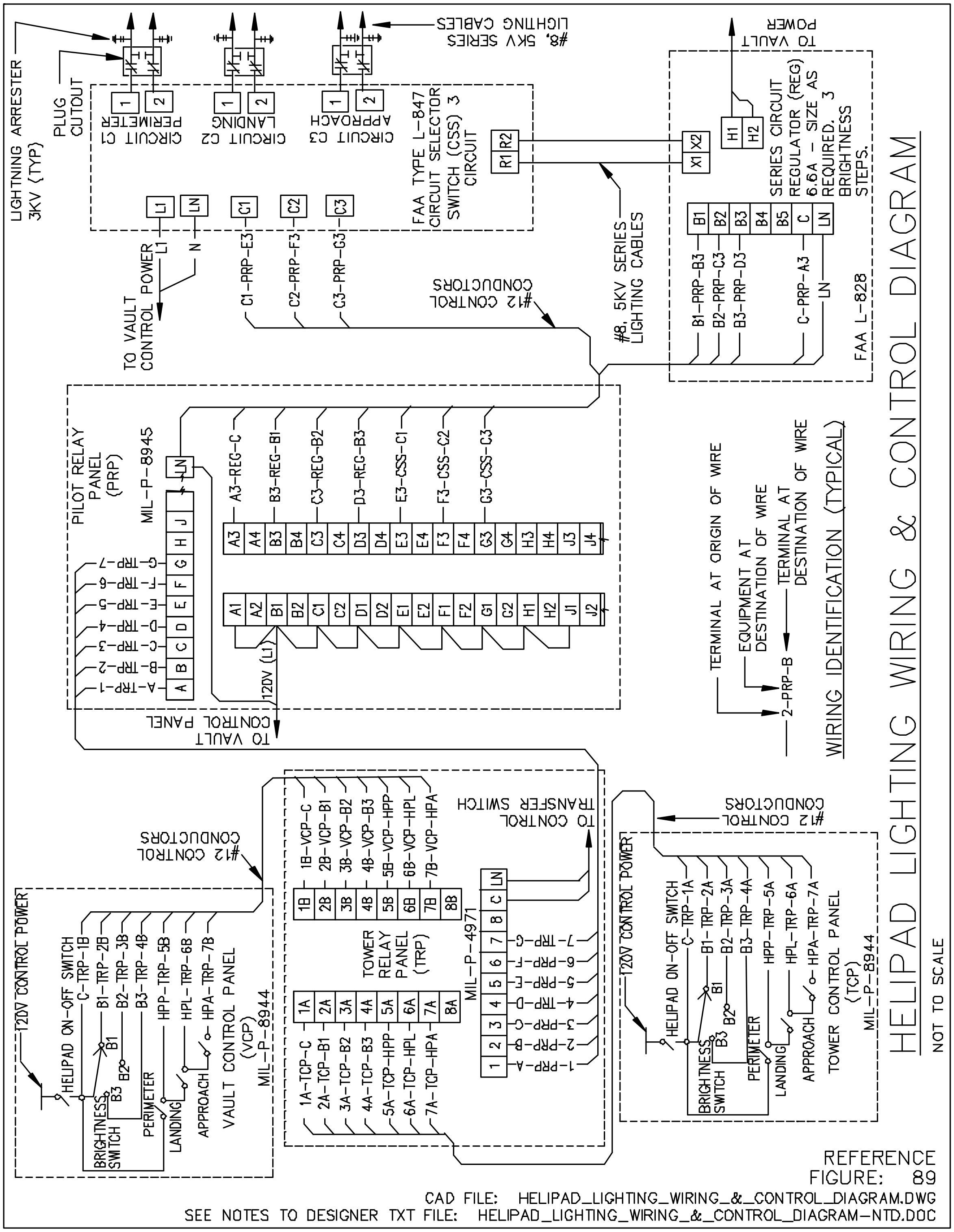


Figure 89. Helipad Lighting Wiring and Control Diagram

Chapter 8: NAVAL FACILITIES SPECIFIC WHEELS-WATCH & WAVE-OFF LIGHTING SYSTEMS

8.1. Location Plans: Wave-off &Wheels-up Lighting Systems

See figure 90.

Notes to Designer:

1. Wave-off Lighting System

   a. Description. The runway wave-off light system consists of sets of simultaneously flashing red lights installed adjacent to the runway which are aimed toward the threshold. They are intended to inform the pilot that an emergency wave-off or missed approach procedure is necessary. The runway wave-off shall be activated from either the control tower, airfield lighting vault, or the wheels-watch station.

   b. Power Requirements. Power for the wave-off power converter unit (PCU) shall be from a 480 volt source. A single 10 kVA minimum 2400/480V pad mount (weatherproof) transformer may supply the power for the wave-off lights via the PCU.

   c. Control Requirements. The wave-off lights shall be controlled manually using momentary-contact type switches. The switches shall be located only at the control tower, airfield lighting vault, and the wheels-watch station.

2. Wheels-up Lighting System

   a. Description. Wheels-up lights are a bar of white lights installed under the approach which are aimed upward and toward the threshold. They are intended to illuminate the underside of landing aircraft to permit observers to determine that the landing gear is fully lowered. The system also includes a portable government furnished wheels-watch shelter which protects the observer from the weather and a wheels-watch control panel.

   b. Power Requirements. Wheel-up lights are connected to 120 Vac multiple circuits requiring somewhat in excess of 10kW. A 15 kVA pad mount transformer (weatherproof) is recommended.

   c. Control Requirements. Wheels-up lights require on/off control and continuous intensity control from 10 to 100 percent of intensity at the rated voltage. This control is required only at the wheels-watch control panel.

   d. The wheels-watch control panel also contains a switch which is activated by the observer that energizes the wave-off lighting system.

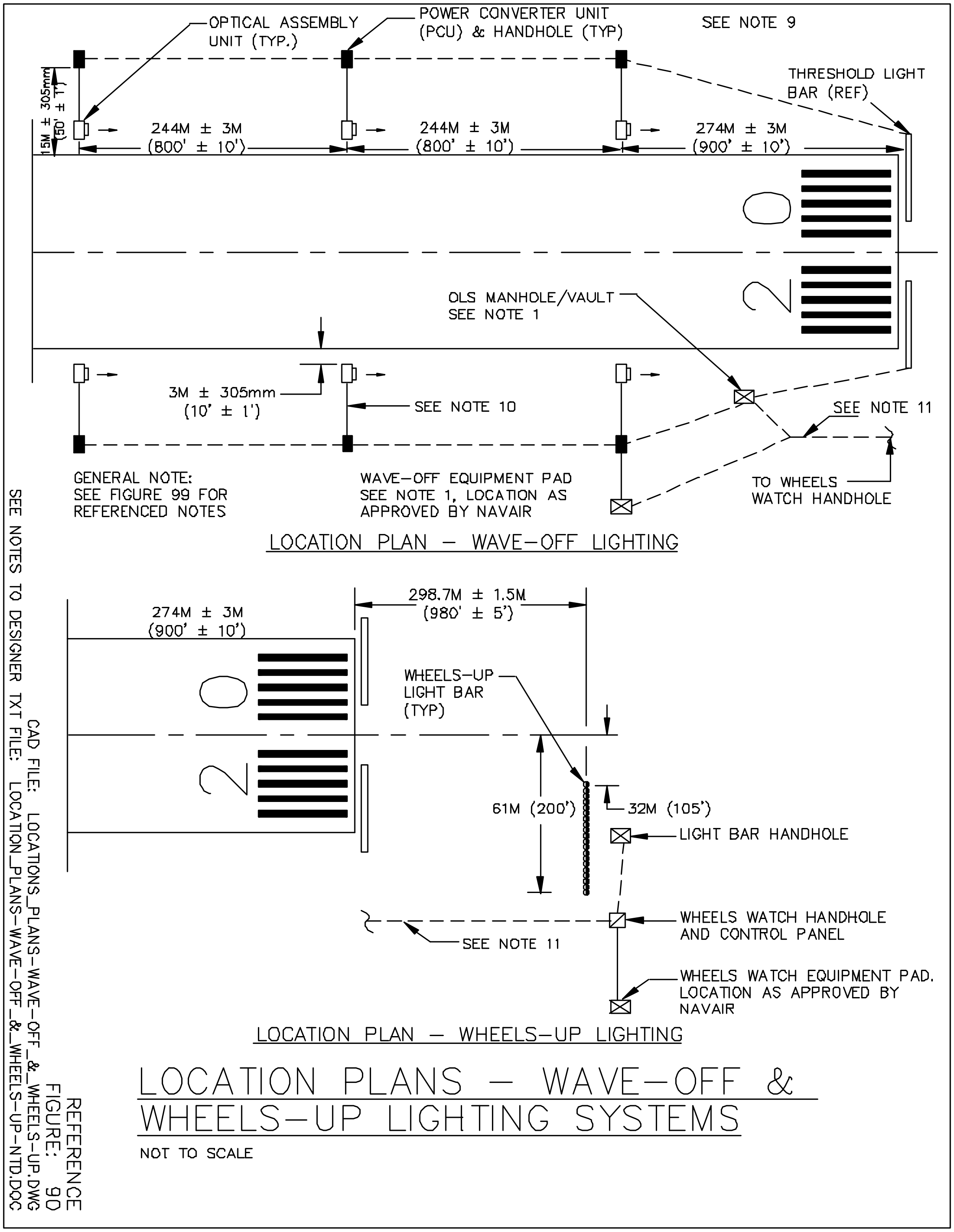


Figure 90. Location Plans: Wave-off and Wheels-up Lighting Systems

8.2. Equipment Pad and Duct Details

See figure 91.

Notes to Designer:

1. The equipment stands for the wave-off and wheels-up systems are freestanding and a maximum of 813mm (32”) above grade.

2. The equipment is rated NEMA 3R (weatherproof). In some areas where corrosion may be a problem (i.e. salt, sand, etc.); the use of NEMA 4x rated equipment may be justified.

3. The equipment pads should be located as close as possible to the lighting system (first P.C.U. of wave-off system and wheels-watch control panel) to limit the voltage drop to the system components. However, NAVFAC ENGCOM should be consulted before placement within the runway safety area or object free zone.

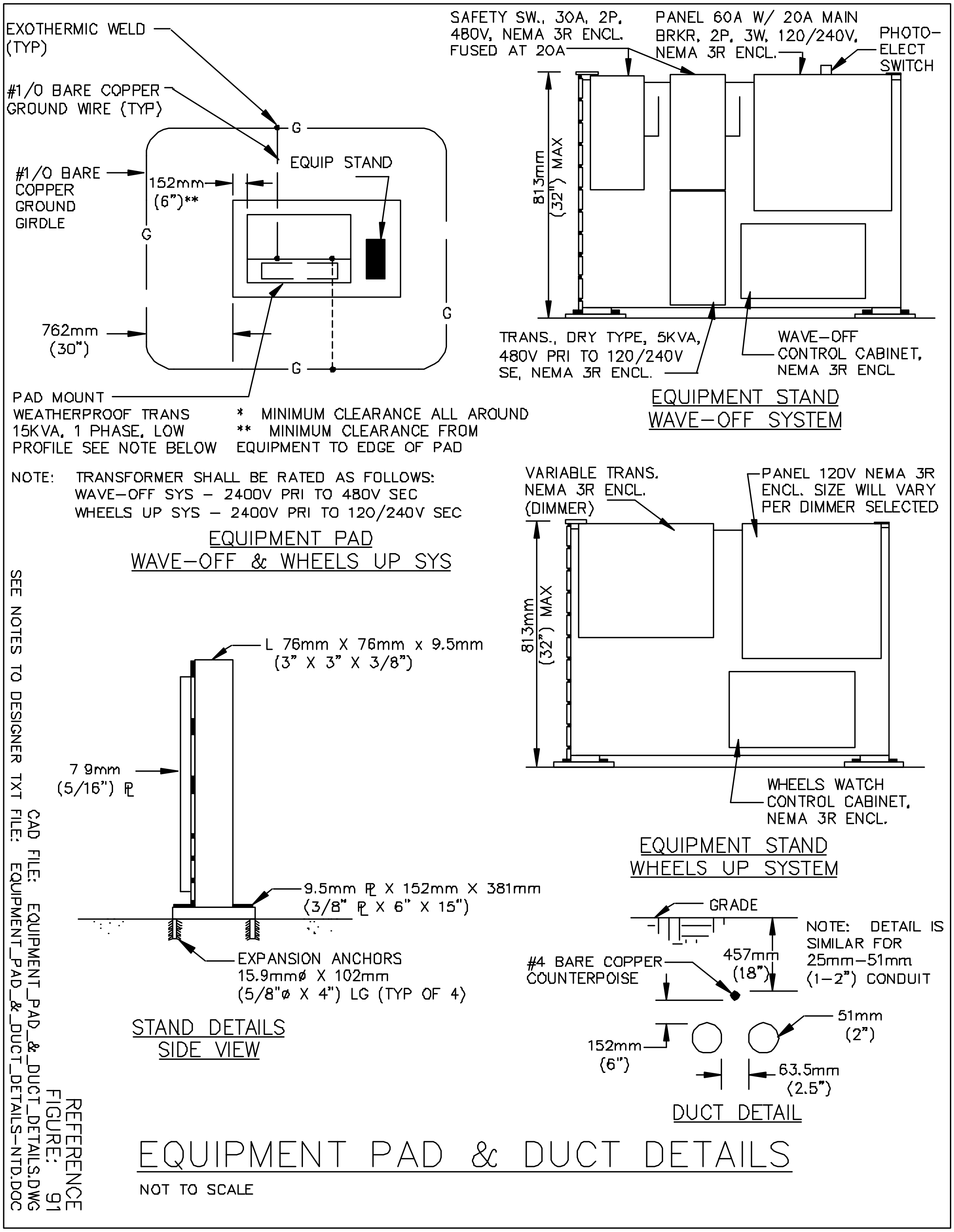


Figure 91. Equipment Pad and Duct Details

8.3. Wave-off System Wiring Details

See figure 92.

Notes to Designer:

1. The wave-off system may be activated by the air traffic controller in the control tower or by personnel in the airfield lighting vault via the transfer relay.

2. The system may also be activated by the observer at the wheels watch control panel.

3. The photoelectric switch controls the intensity of the wave-off system. The system operates at maximum intensity during daytime hours and reduced intensity during hours of darkness.

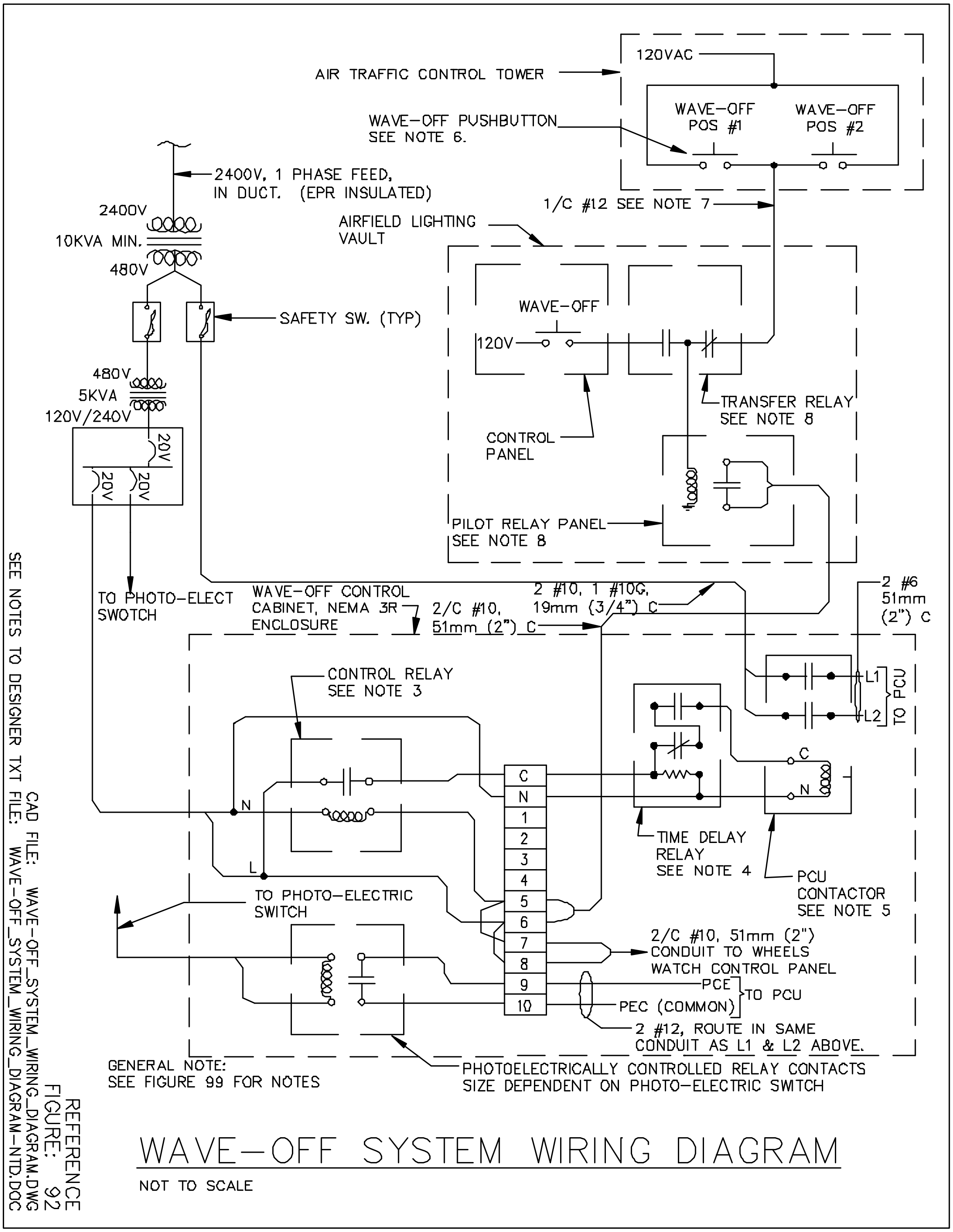


Figure 92. Wave-off System Wiring Details

8.4. Flashhead and PCU Wiring Diagram

See figure 93.

Notes to Designer:

1. 480 Volts, single phase power is delivered to each power converter unit (PCU) from the PCU contactor located in the wave-off control cabinet.

2. Intensity control to each PCU is routed in the same conduit as the power conductors and originates at the photo-electrically controlled relay in the wave-off control cabinet.

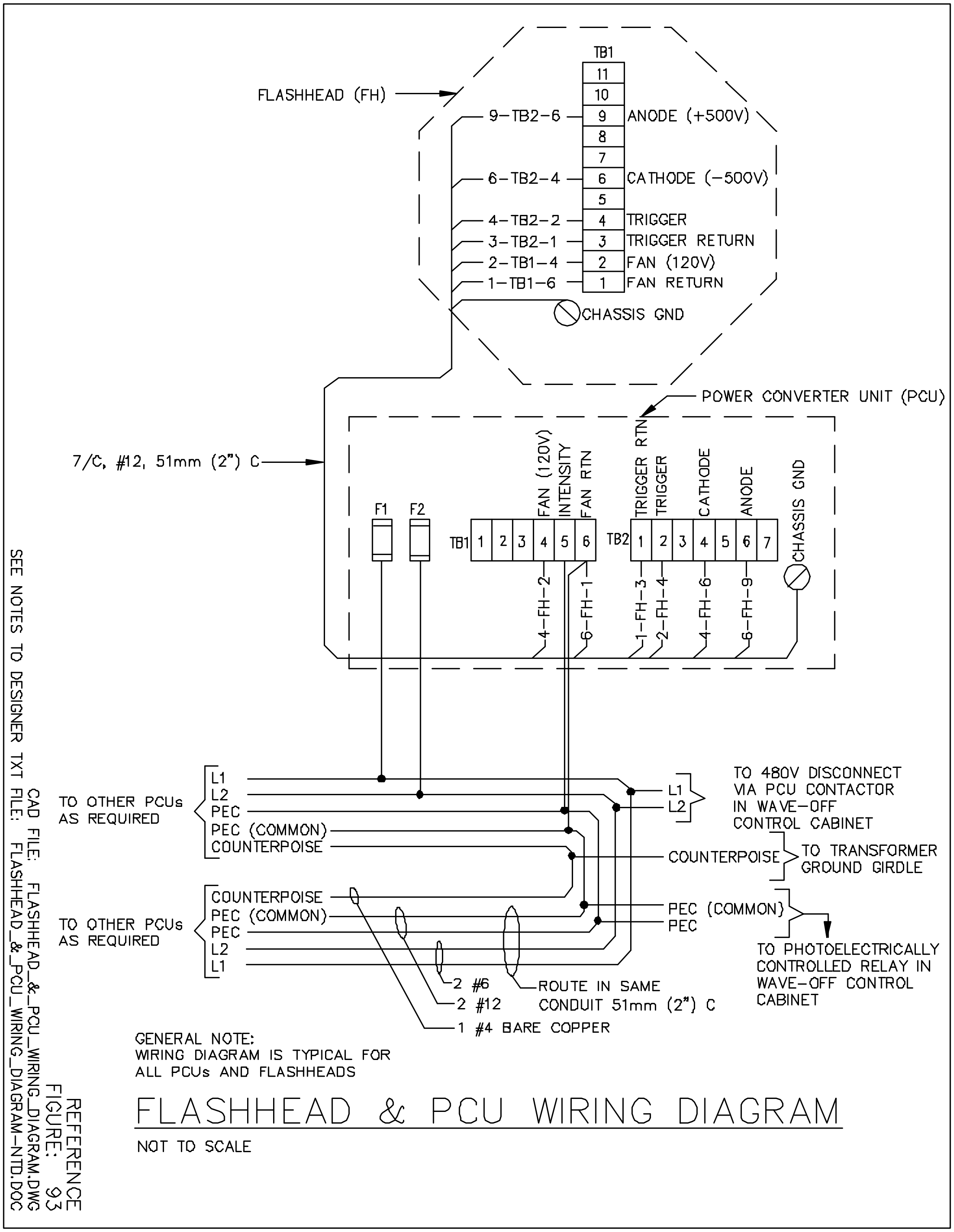


Figure 93. Flashhead and PCU Wiring Diagram

8.5. Wave-off Fixture Mounting

See figure 94.

Notes to Designer:

1. The optical assembly (flashhead) is mounted on an FAA type L-867 concrete encased light base.

2. The flexible non-metallic conduit allows play in the 2” conduit due to freeze-thaw cycles in frost susceptible areas.

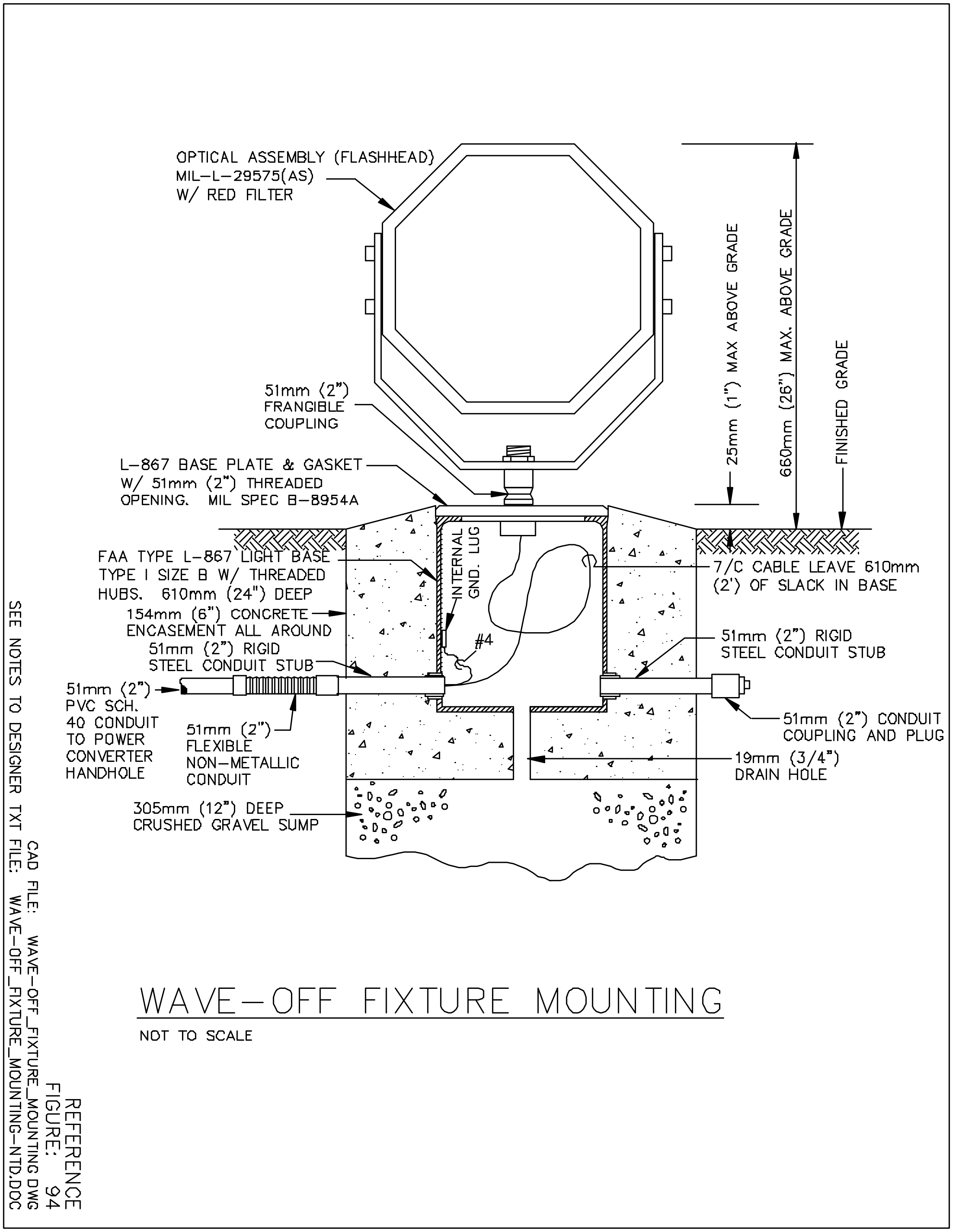


Figure 94. Wave-off Fixture Mounting

8.6. Wave-off Fixture Aiming

See figure 95.

Notes to Designer:

1. The wave-off fixture is aimed towards the landing aircraft as shown.

2. Construction document should include the aiming requirements.

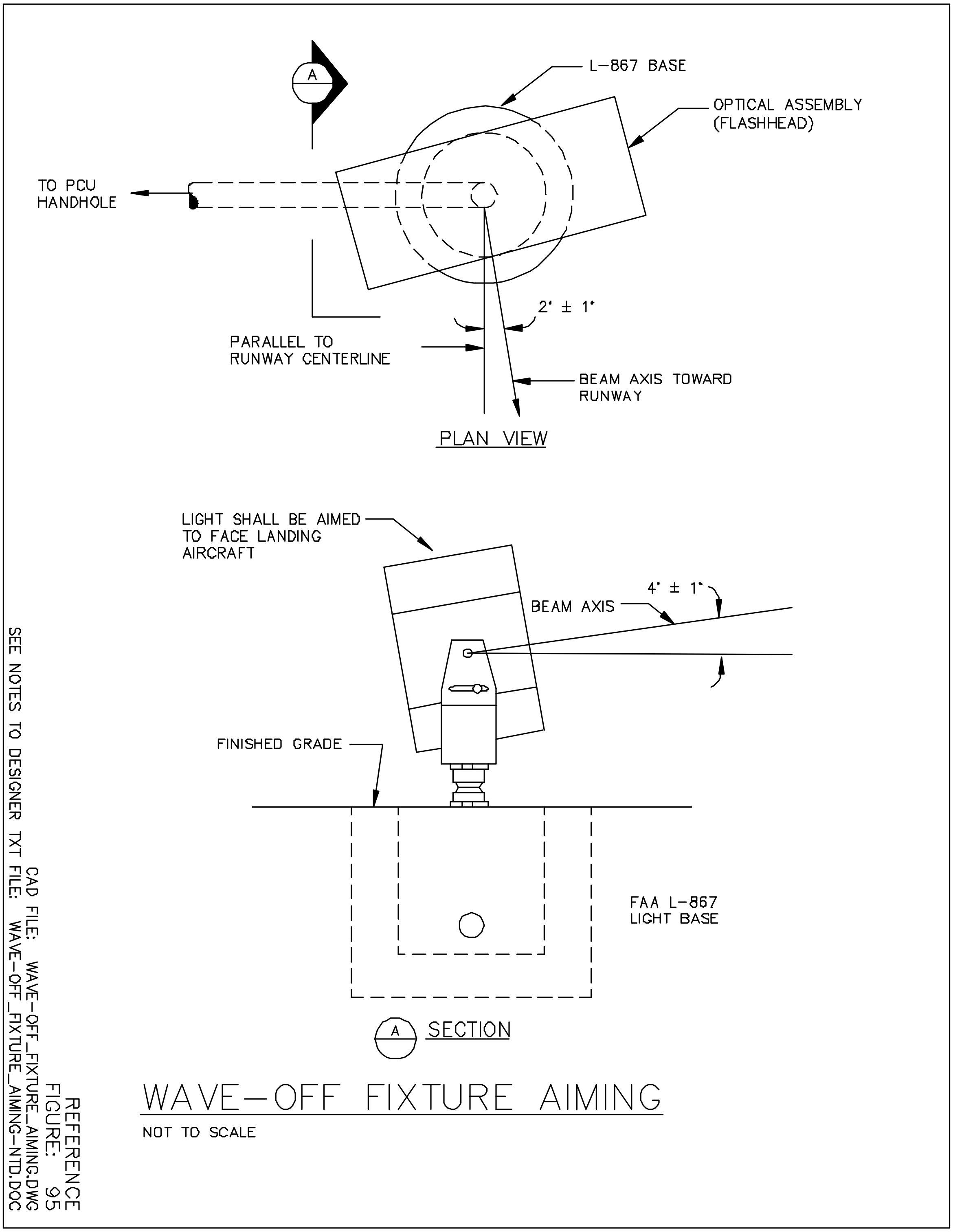


Figure 95. Wave-off Fixture Aiming

8.7. Power Converter Unit

See figure 96.

Notes to Designer:

1. An alternative to the concrete handhole would be to use an FAA type L-867 Size D (16” ∅) light base concrete encased. Conduit openings are 2” thread hubs and must be specified ((2) 2” one above the other at 0° and 180°, (1) 2” at 90° and 270°).

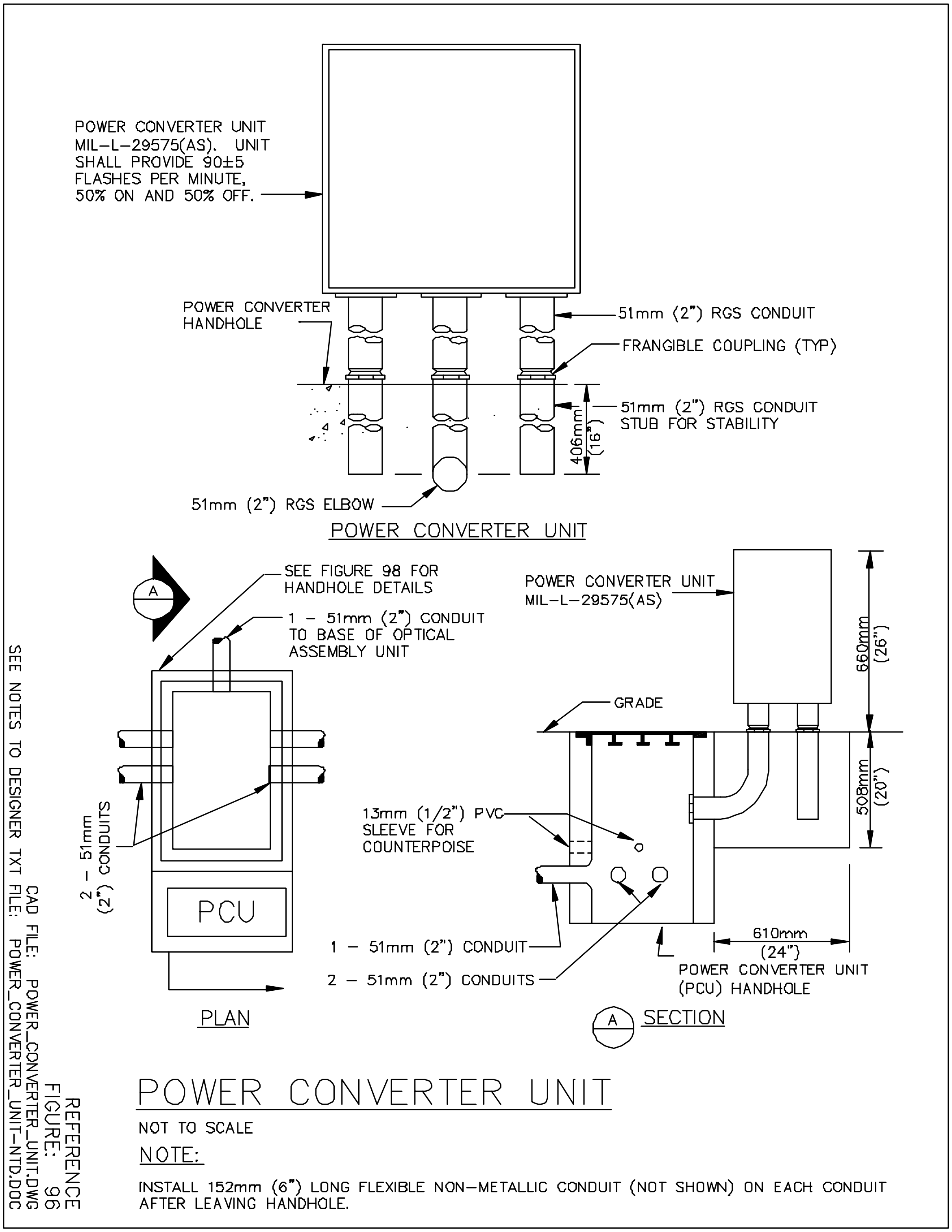


Figure 96. Power Converter Unit

8.8. Concrete Handhole

See figure 97.

Notes to Designer:

1. This figure is for a typical concrete handhole 15” x 30” with a steel removable cover.

2. The handhole is used as the wave-off PCU handhole, the wheels-up light bar handhole, and the wheels-watch handhole.

3. An alternative to the concrete handhole would be to use an FAA type L-867 Size D (16” ∅) light base with 2” threaded conduit hubs located as required.

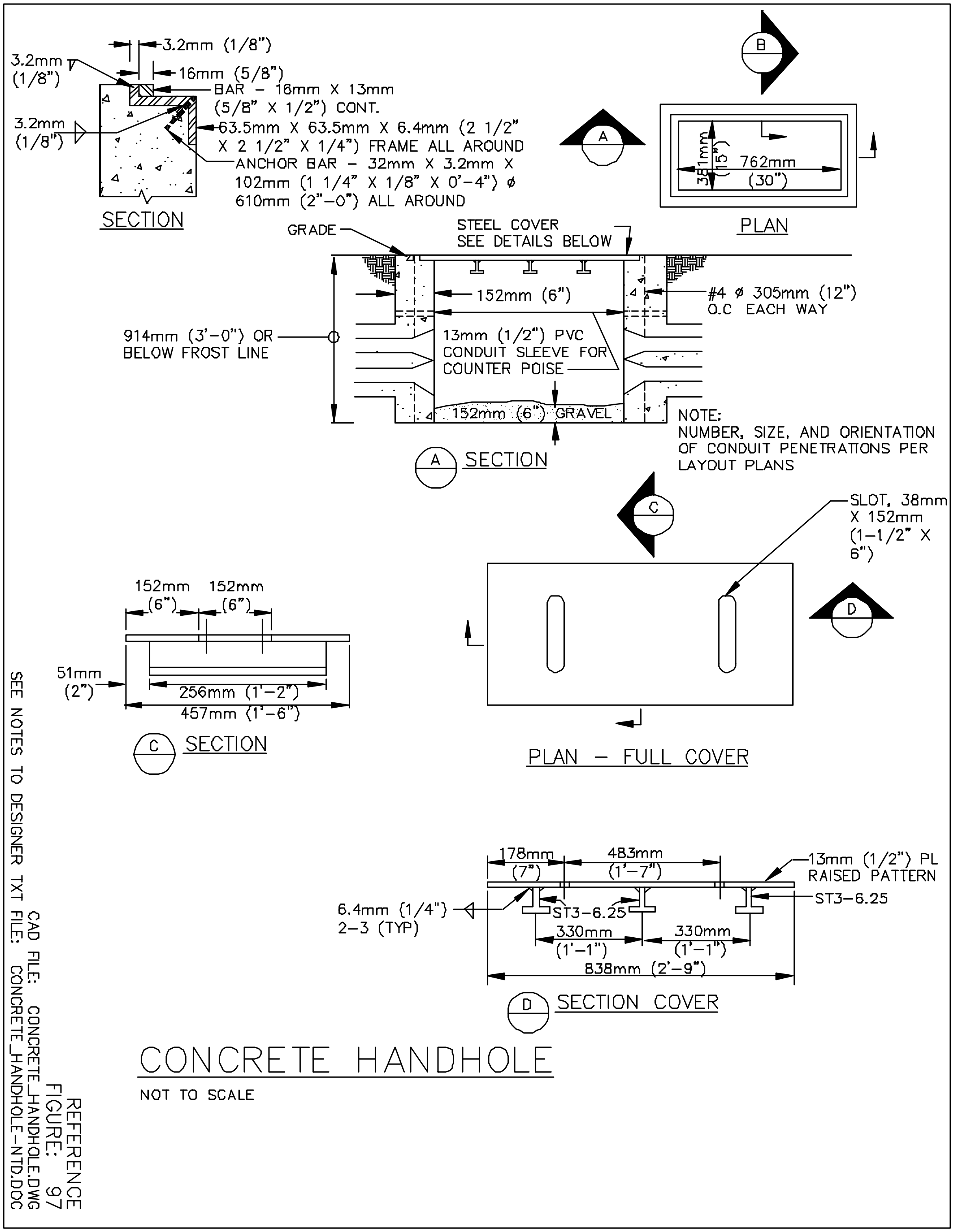


Figure 97. Concrete Handhole

8.9. Wave-off Lighting System

See figure 98.

Notes to Designer:

1. These notes are referenced in the different figures of the wave-off lighting system.

2. Review these notes and revise the figures accordingly.

3. More recent installations have been to install the equipment above grade rather than in an OLS manhole/vault. New installations should have all equipment installed above grade.

NOTES

1. IF AN OPTICAL LANDING SYSTEM (OLS) MANHOLE/VAULT WITH 480VAC POWER IS NOT AVAILABLE, PROVIDE AN EQUIPMENT PAD WITH PAD MOUNT TRANSFORMER AS DETAILED ON FIGURE 92. IN ADDITION MODIFY THE CONTROLS AS SHOWN ON FIGURE 93. THE CONTROLS MAY BE LOCATED IN THE OLS MANHOLE/VAULT IF ONE EXISTS.

2 ALL EQUIPMENT IN THE UNDERGROUND MANHOLE/VAULT SHALL EITHER BE SUBMERSIBLE OR INSTALLED WITHIN A SUBMERSIBLE ENCLOSURE, NEMA 6P ENCL.

3 CONTROL RELAY SHALL BE GENERAL PURPOSE, HERMETICALLY SEALED, 4PDT, 3 AMP CONTACTS WITH 120VAC, 60Hz COIL.

4. TIME DELAY RELAY SHALL HAVE 10 AMP, 120VAC CONTACTS WITH 120VAC 60Hz COIL RELAY SHALL HAVE ONE NORMALLY OPEN (N.O) INSTANTANEOUS CONTACTS AND ONE NORALLY CLOSED (N.C.) TIME DELAY OPENING CONTACT ADJUSTABLE FROM 5 TO 60 SECOND DELAY ON ENERGIZING BUT INITIALLY SET FOR 15 SECONDS DELAY.

5. CONTACTOR SHALL HAVE TWO N.O., 30 AMP, 480VAC CONTACTS WITH 120VAC, 60Hz COIL.

6. WAVE-OFF PUSHBUTTONS SHALL BE N.O. MOMENTARY CONTACTS. LOCATE PUSHBUTTONS WITHIN CONTROL TOWER AS DIRECTED BY THE AIR TRAFFIC CONTROL OFFICER.

7. IF POSSIBLE USE SPARE CONDUCTORS IN THE CONTROL TOWER THAT RUNS BETWEEN THE AIRFIELD LIGHTING VAULT AND THE CONTROL PANEL WITHIN THE CONTROL TOWER.

8 IF AVAILABLE USE SPARE PILOT AND TRANSFER RELAYS WITHIN THE AIRFIELD LIGHTING VAULT.

9. PROVIDE 2 – 51mm (2") CONDUITS (1 – SPARE) BETWEEN POWER CONVERTER UNITS (PCU). ALSO PROVIDE 2 – 51mm (2") CONDUITS (1 – SPARE) BETWEEN PCU AND THRESHOLD.

10. PROVIDE 1 – 51mm (2") CONDUIT BETWEEN PCUs AND OPTICAL ASSEMBLY UNITS.

11. IF THE WAVE-OFF CONTROLS ARE LOCATED IN THE OLS MANHOLE/VAULT ROUTE 1 – 51mm (2") CONDUIT FROM MANHOLE/VAULT TO WHEELS WATCH HANDHOLE OTHERWISE ROUTE 1 – 51mm (2") COUNDUIT FROM WAVE-OFF EQUIPMENT PAD TO WHEELS WATCH HANDHOLE.

GENERAL NOTES
WAVE-OFF LIGHTING SYSTEM

REFERENCE
FIGURE: 98
CAD FILE: WAVE-OFF_LIGHTING_SYSTEM.DWG
SEE NOTES TO DESIGNER TXT FILE: WAVE-OFF_LIGHTING_SYSTEM-NTD.DOC

Figure 98. Wave-off Lighting System

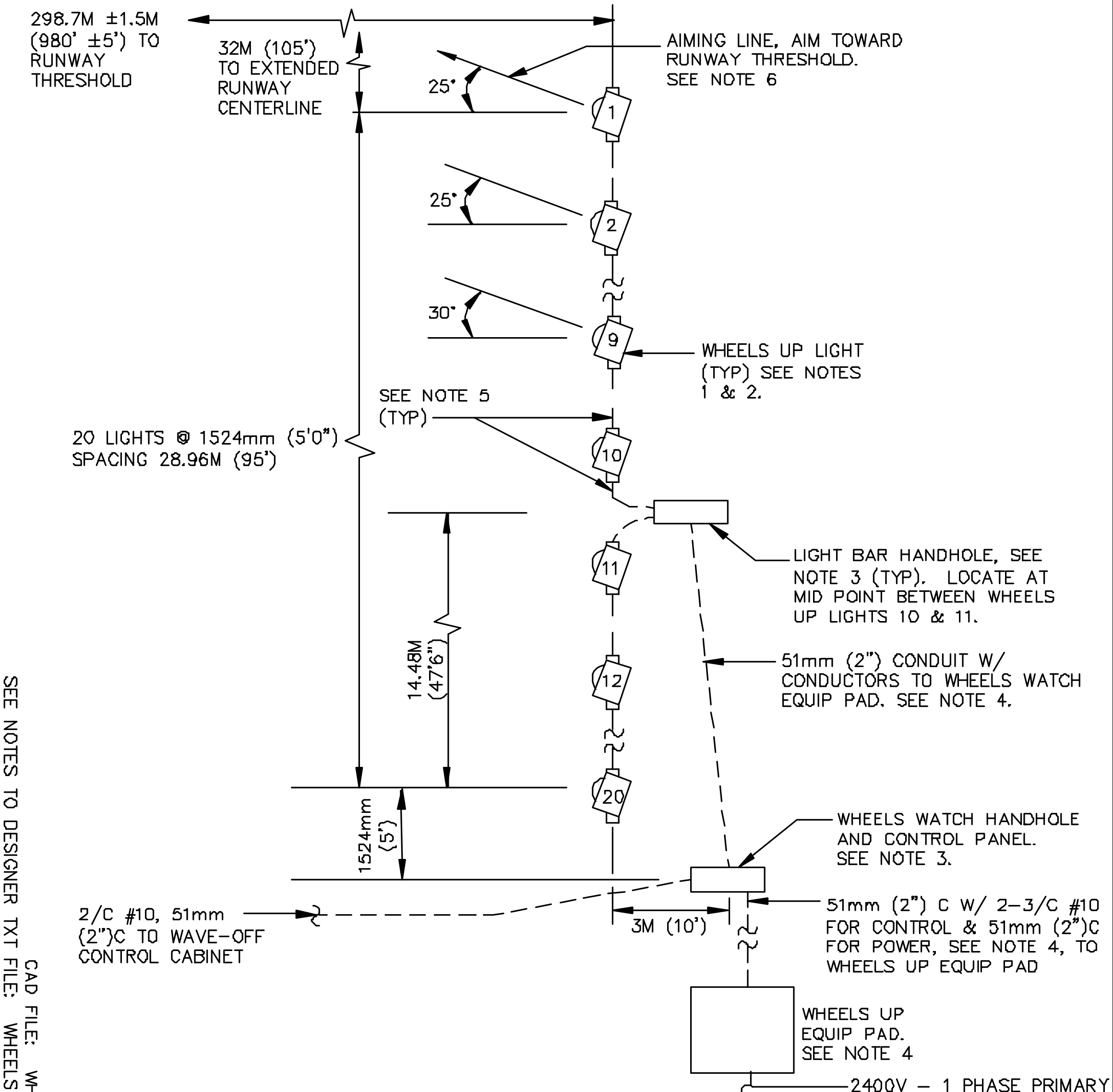
8.10. Wheels-watch System Layout

See figure 99.

Notes to Designer:

1. The wheels-up lights are located and aimed as indicated.

2. Coordinate with NAVAIR on location of the equipment pad. Design for a maximum voltage drop of ±4% total from the equipment pad to the farthest fixture in the system. #6 AWG shall be the minimum wire size.



SEE NOTES TO DESIGNER TXT FILE: WHEELS-WATCH_SYSTEM_LAYOUT-NTD.DOC

CAD FILE: WHEELS-WATCH_SYSTEM_LAYOUT.DWG

REFERENCE FIGURE: 99

WHEELS–WATCH SYSTEM LAYOUT

NOT TO SCALE

NOTES:

1. WHEELS UP LIGHT BAR SHALL BE LOCATED ON SAME SIDE OF RUNWAY AS THE CONTROL TOWER.
2. RELOCATION OR RE–AIMING OF LIGHT BAR REQUIRES APPROVAL OF NAVFACENGCOM.
3. SEE FIGURE 98 FOR HANDHOLE DETAILS.
4. CONDUCTOR SIZE BETWEEN LIGHT BAR HANDHOLE AND WHEELS UP EQUIPMENT PAD SHALL BE DETERMINED ONCE LOCATION OF EQUIPMENT PAD IS APPROVED BY NAVAIR. THE TOTAL VOLTAGE DROP FOR THE WHEELS–UP LIGHTING CIRCUIT SHALL BE MAINTAINED TO ±4% OR LESS.
5. CONDUCTOR SIZE BETWEEN LIGHT BAR HANDHOLE AND WHEELS–UP LIGHTS SHALL BE 2 #6, 1 #6G IN 51mm (2") CONDUIT.
6. THE THREE (3) INNER MOST LIGHTS ARE AIMED TOWARD THE RUNWAY AT 25°.

Figure 99. Wheels-watch System Layout

8.11. Wheels-up Wiring Diagram

See figure 100.

Notes to Designer:

1. The observer varies the intensity of the lights by the potentiometer located in the control panel.
2. Activation of the wave-off system is accomplished by the wave-off control connected to the control panel by a flexible cord.

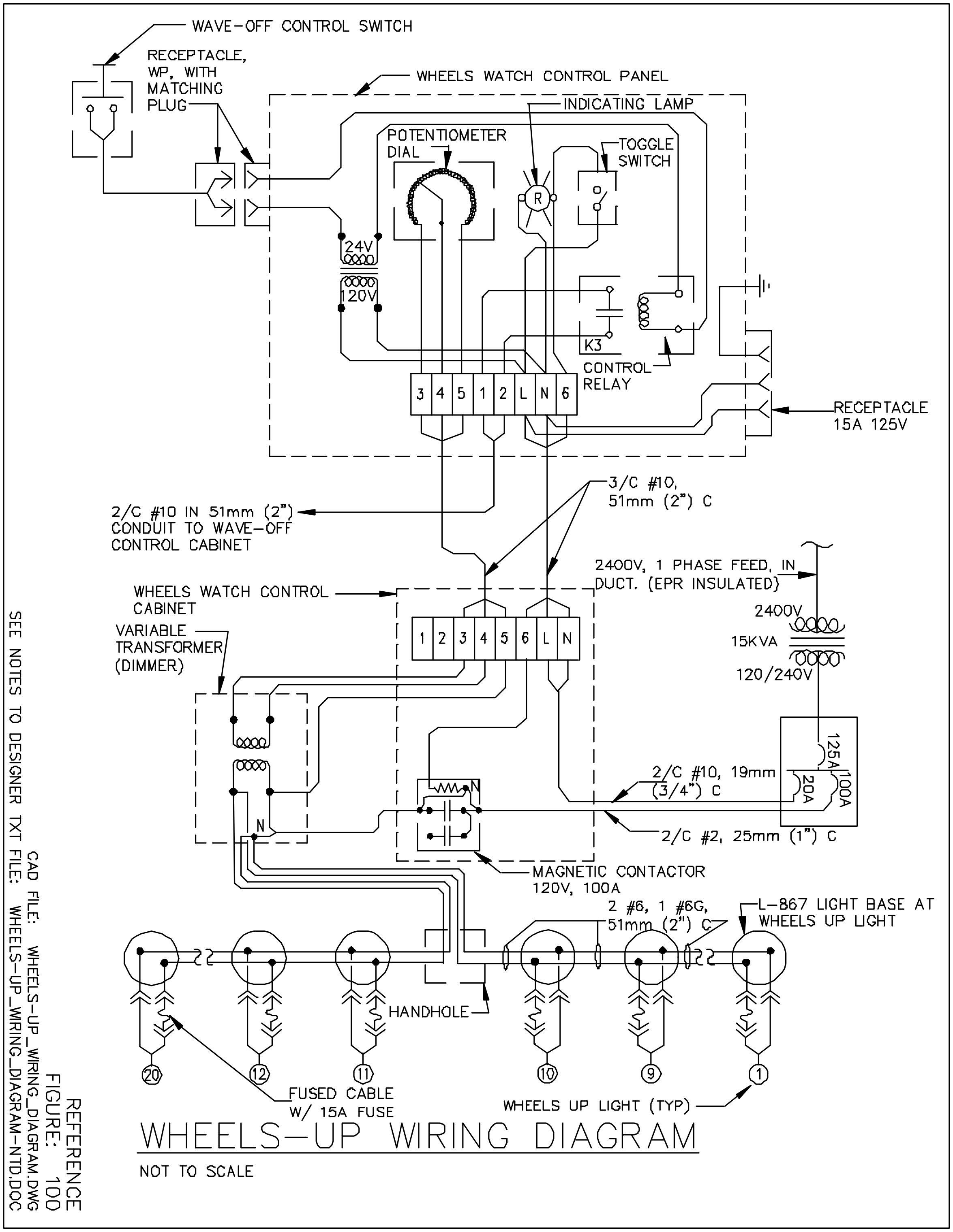


Figure 100. Wheels-up Wiring Diagram

8.12. Wheels-up Light Fixture

See figure 101.

Notes to Designer:

1. The wheels-up lighting system is a constant voltage system. The lamp shorting device which is part of an FAA-E-982 fixture is not used.

2. The flexible non-metallic conduit allows play in the conduit due to freeze-thaw cycles in areas susceptible to frost penetration.

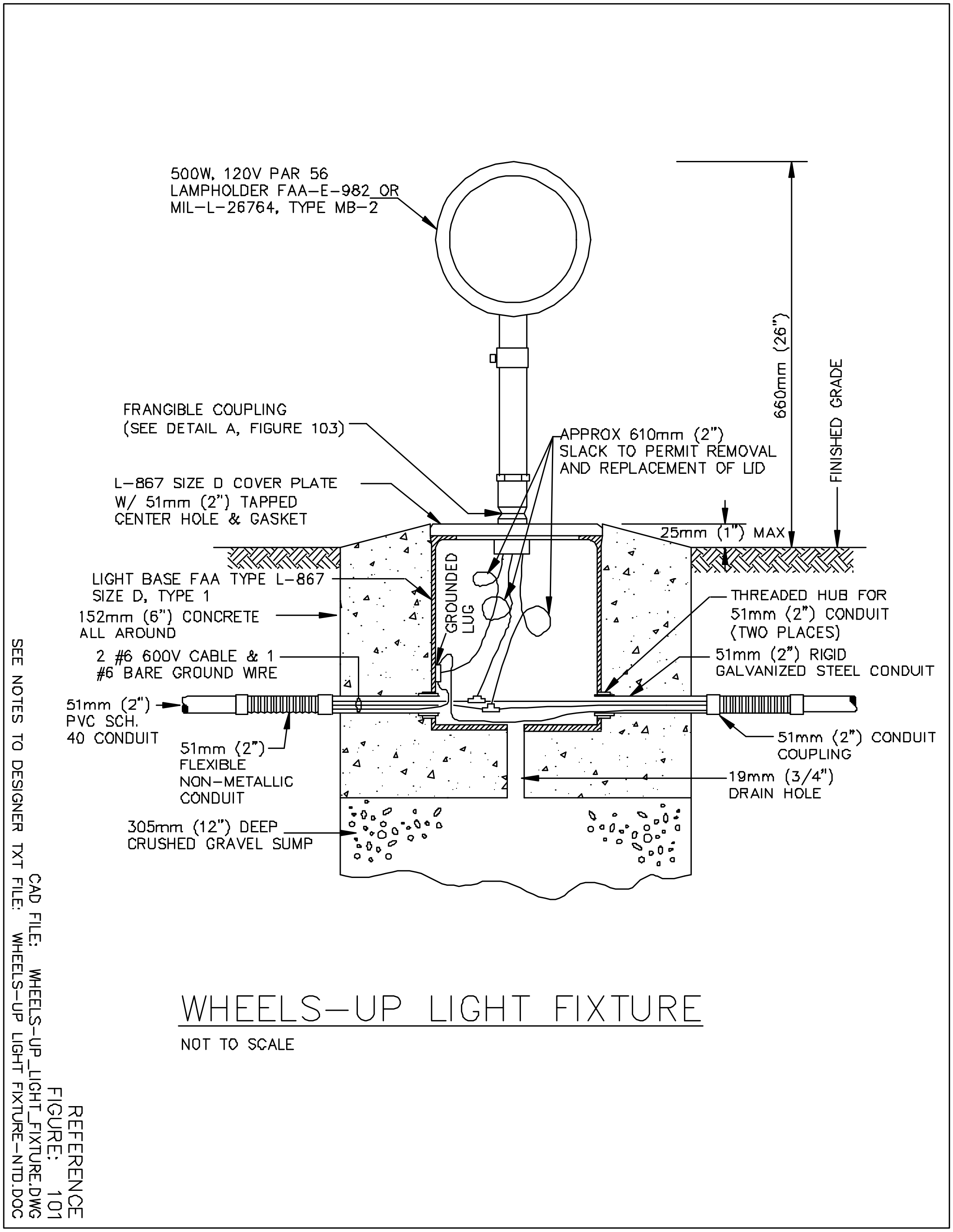


Figure 101. Wheels-up Light Fixture

8.13. Detail “A” Wheels-up Fixture

See figure 102.

Notes to Designer:

1. The in-line fuse sets inside the EMT conduit. Enough slack should be provided such that the fuse is accessible when the EMT is removed from the frangible coupling.

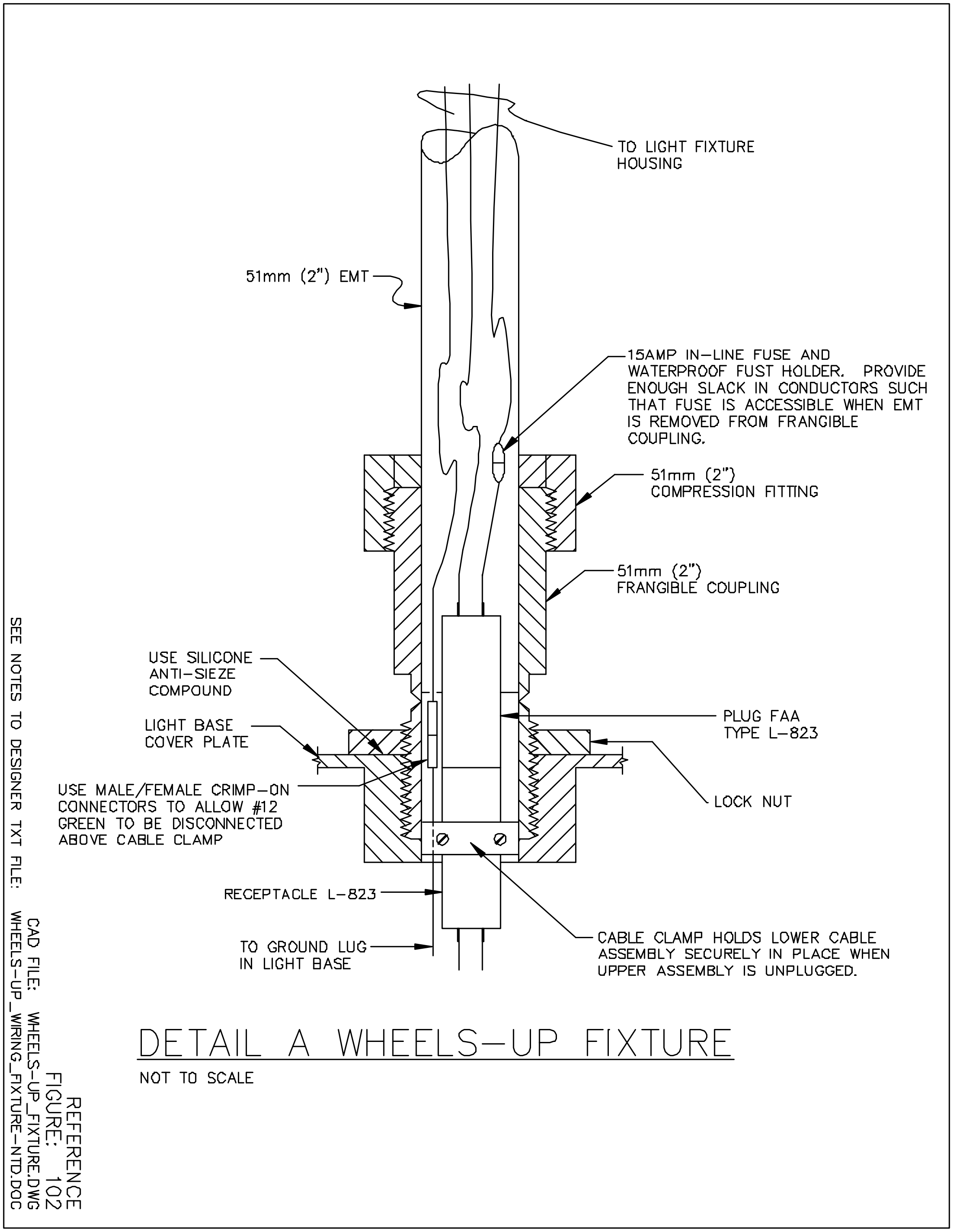


Figure 102. Detail “A” Wheels-up Fixture

8.14. Wheels-watch Control Panel

See figure 103.

Notes to Designer:

1. An alternate to the concrete handhole would be an FAA type L-867 Size D (16” ∅) concrete encase light base with 2” threaded hubs for conduit located at 0°, 90°, and 180°.

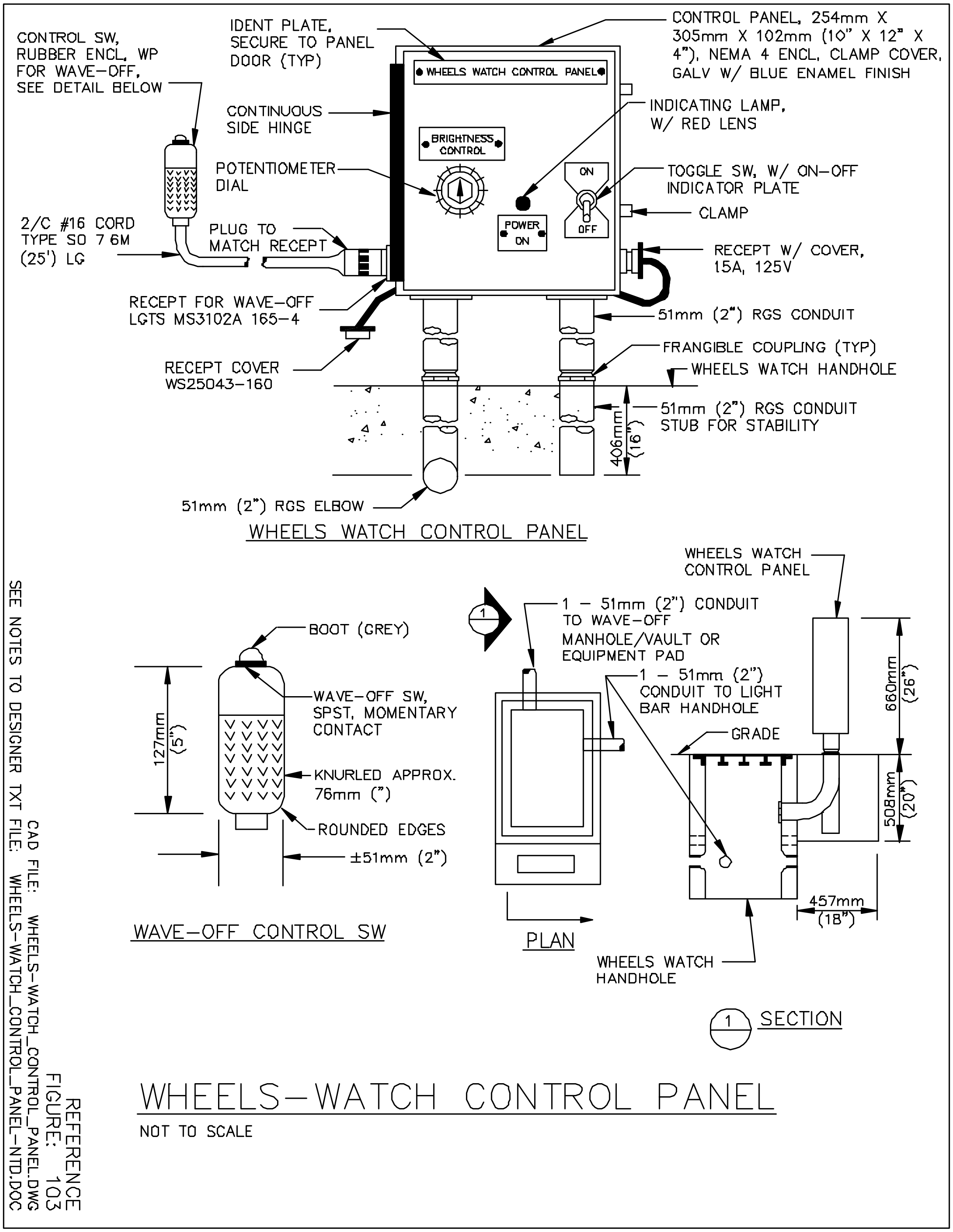


Figure 103. Wheels-watch Control Panel

Chapter 9: NAVAL FACILITIES SPECIFIC SIMULATED CARRIER DECK SYSTEMS

9.1. Simulated Carrier Deck Lighting System Layout Plan & Wiring Diagram

See figure 104.

Notes to Designer:

GENERAL: The simulated carrier deck lighting system is installed on a runway along with the associated carrier deck markings to provide a training and practice environment for carrier deck approaches and landings. The system is controlled by a landing signals officer (LSO) via a portable control panel and control switch. The panel and switch are connected to a submersible terminal box located in the LSO handhole.

1. Siting of simulated carrier deck lighting system shall be in accordance with NAVAIR 51-50AAA-2.

2. Designer shall lay out simulated carrier deck saw kerfs for minimal crossing of centerline lighting system saw kerfs.

3. All wiring installed in saw kerfs shall be single conductor #10 AWG, 600V, type THWN.

4. For new runway construction, the entire width of the deck lighting system shall be portland cement concrete. Airfield lighting designer shall coordinate installation of FAA L-868 light bases and 51mm (2”) conduit with isolation transformers in each light base.

5. Where simulated carrier deck lighting systems are to be installed in existing runways having a flexible pavement surface, guidance shall be received from COMNAVFACENGCOM.

6. Inset light fixtures shall be a 45 watt, 6.6 amp, semiflush, unidirectional inset light per FAA L-852N, type V or VI. Base mounted type shall be either type VII or VIII. Fixture shall have extra strength stainless steel housing and thickened, hardened top optical casting. Lamps shall be provide with a shorting disc to allow operation of other lamps upon single lamp burnout.

7. Distance from runway to handhole varies 3M (10’) maximum. Designer will minimize offset distance to satisfy field conditions.

8. Marking of runway pavement for simulated carrier deck system shall comply with NAVAIR 51-50AAA-2.

9. Lights are aimed parallel with the centerline and toward the runway threshold.

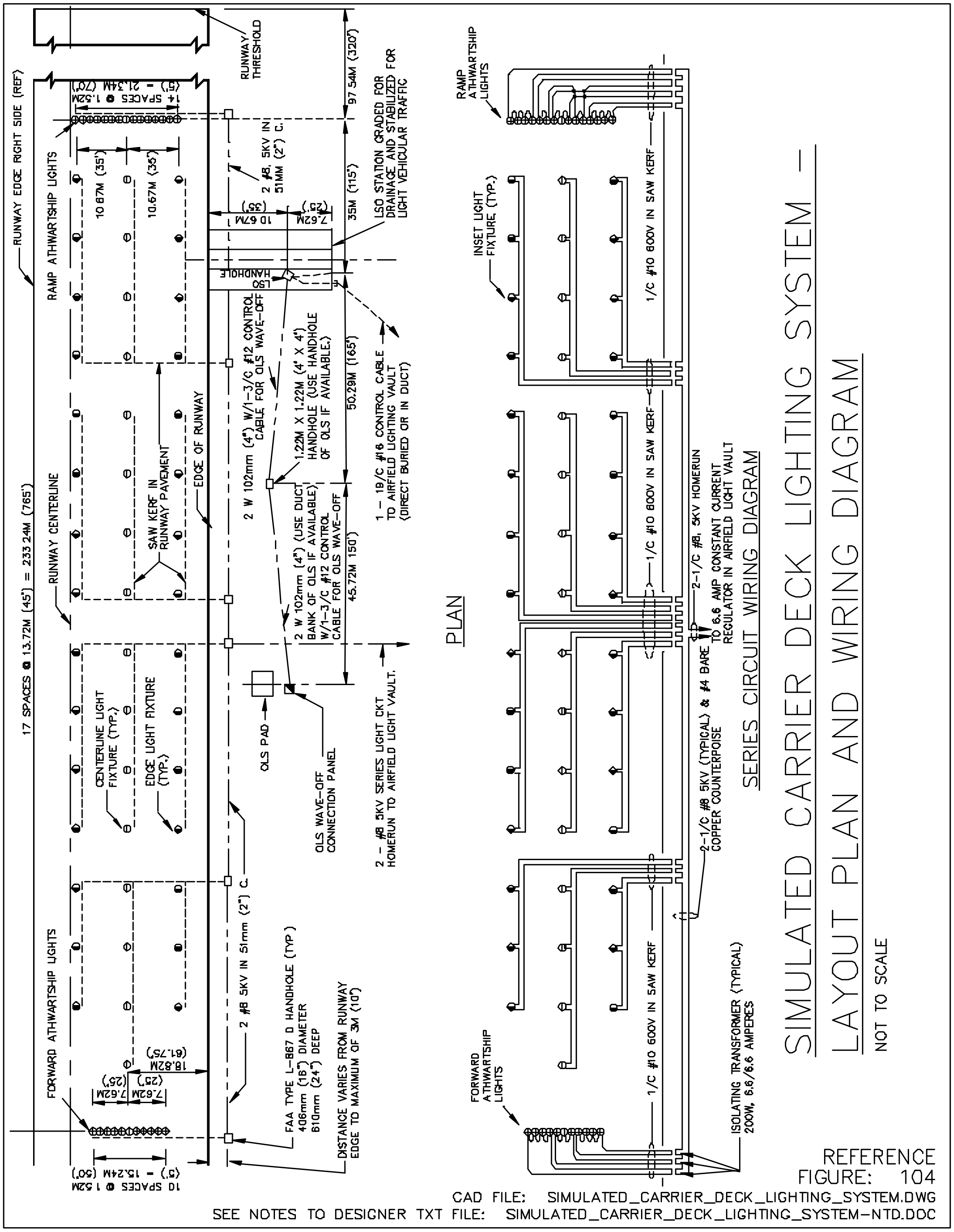


Figure 104. Simulated Carrier Deck Lighting System Layout Plan & Wiring Diagram

9.2. L.S.O. Handhole Details

See figure 105.

Notes to Designer:

1. The L.S.O. handhole houses a submersible terminal box and receptacle. This serves as a junction point for connecting the multiconductor cables from the L.S.O. control panel, portable OLS (optical landing system), and the airfield lighting vault.

2. The handhole is located 35M (115’) upwind from the ramp athwartship lights and 18.9M (62’) outboard of the simulated carrier deck edge lights. A 13.4M (44’) wide area extending outboard 18.3M (60’) from the runway edge shall be provided. This area shall be graded for drainage and stabilized for light vehicular traffic.

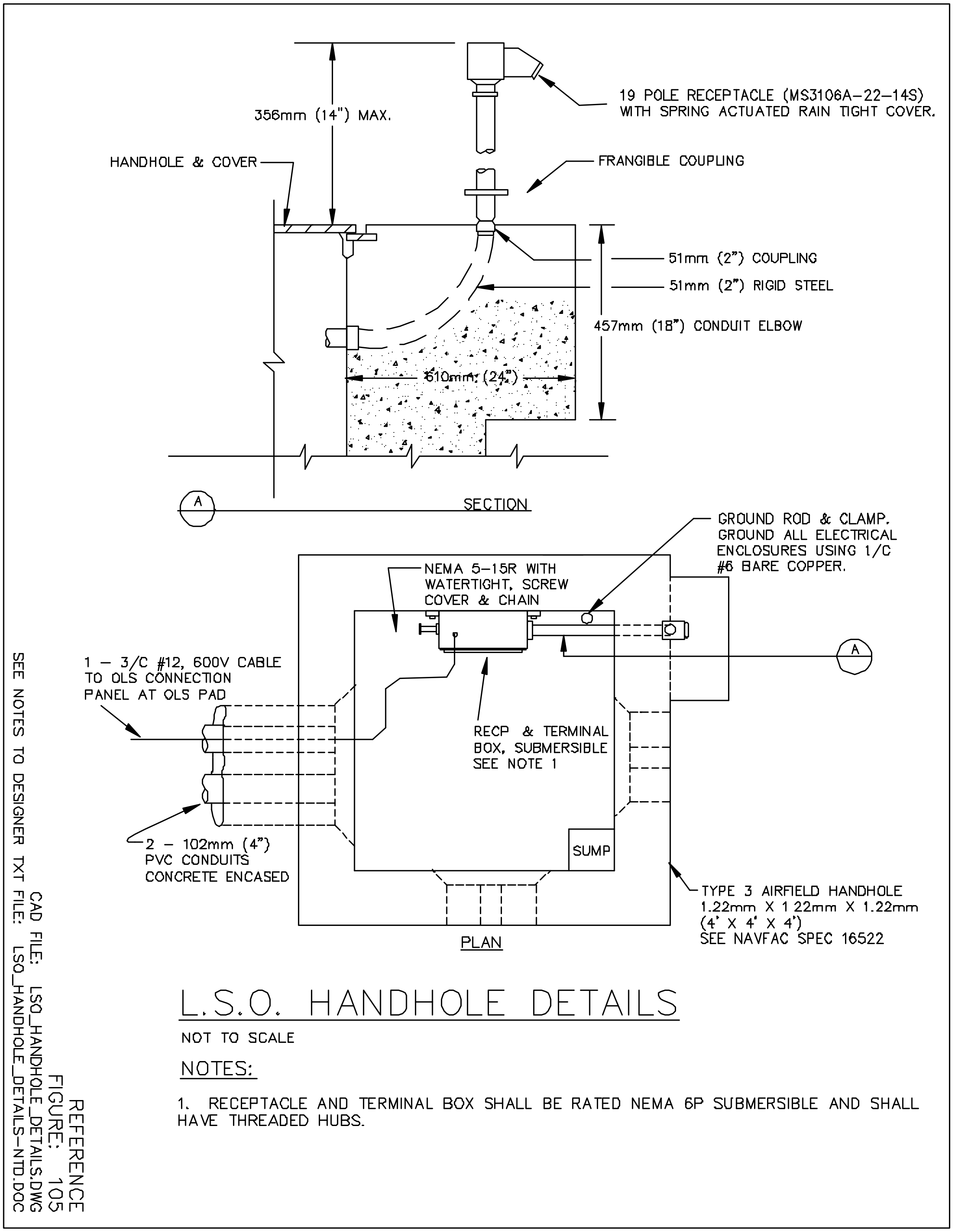


Figure 105. L.S.O. Handhole Details

9.3. Handhole and Transformer Housing

See figure 106.

Notes to Designer:

1. The flexible conduit allows for flexibility of the conduit runs during freeze/thaw cycles in cold climates and should be at least 305mm (12”) long.

2. The handhole should be specified with both an internal and external ground lug. The entire handhole is then bonded to a ground rod by a #6 bare copper pigtail.

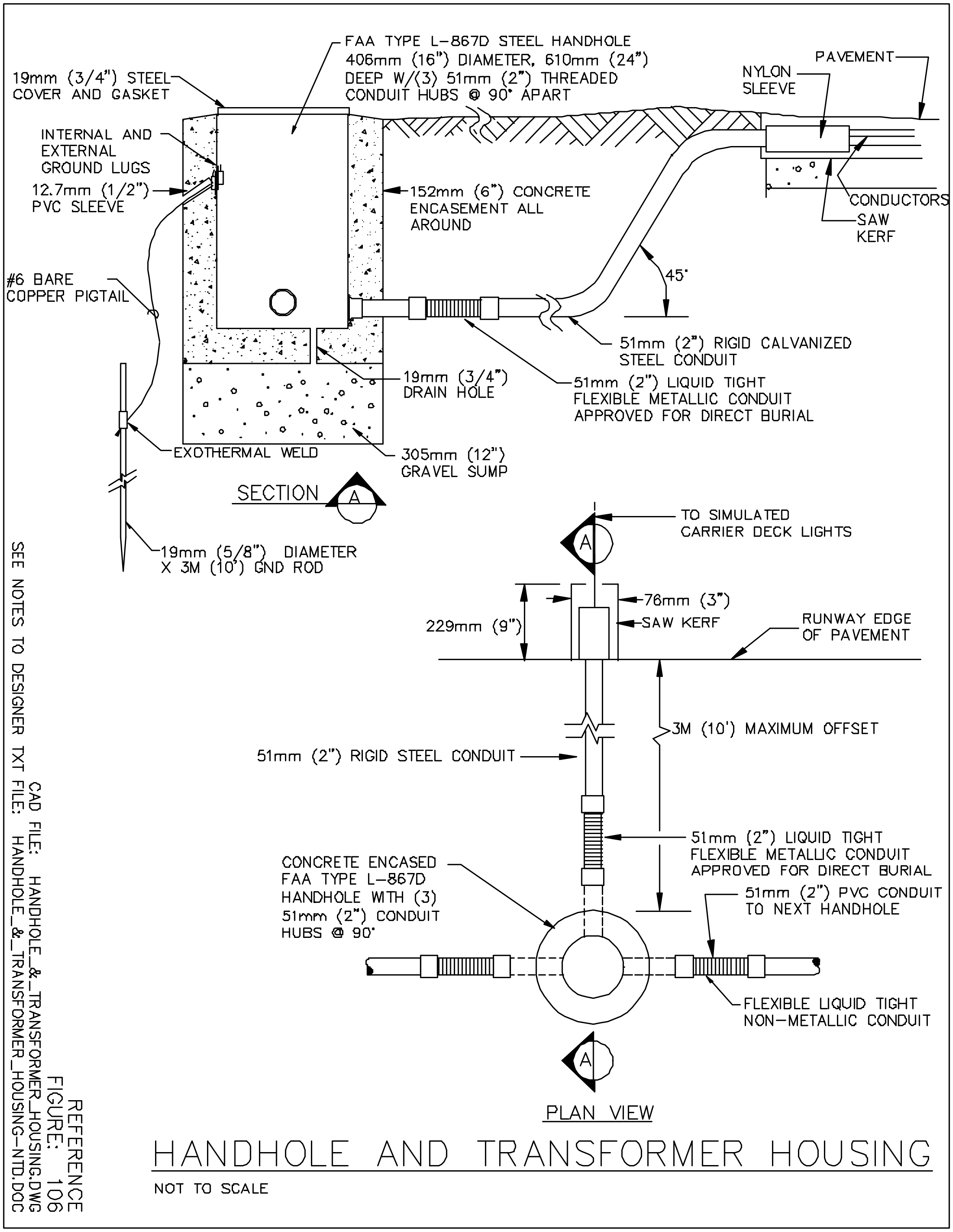


Figure 106. Handhole and Transformer Housing

9.4. Simulated Carrier Deck Lighting Control Wiring Diagram

See figure 107.

Notes to Designer:

1. The control wiring diagram shown is for two carrier deck lighting systems at opposite ends of the runway and utilizing a 3 step regulator. Where a single system is installed and/or a 5 step regulator is used, modify the wiring diagram as required to show the type system installed.

2. When the carrier deck system is using an optical landing system (OLS), the runway wave-off system shall not be used.

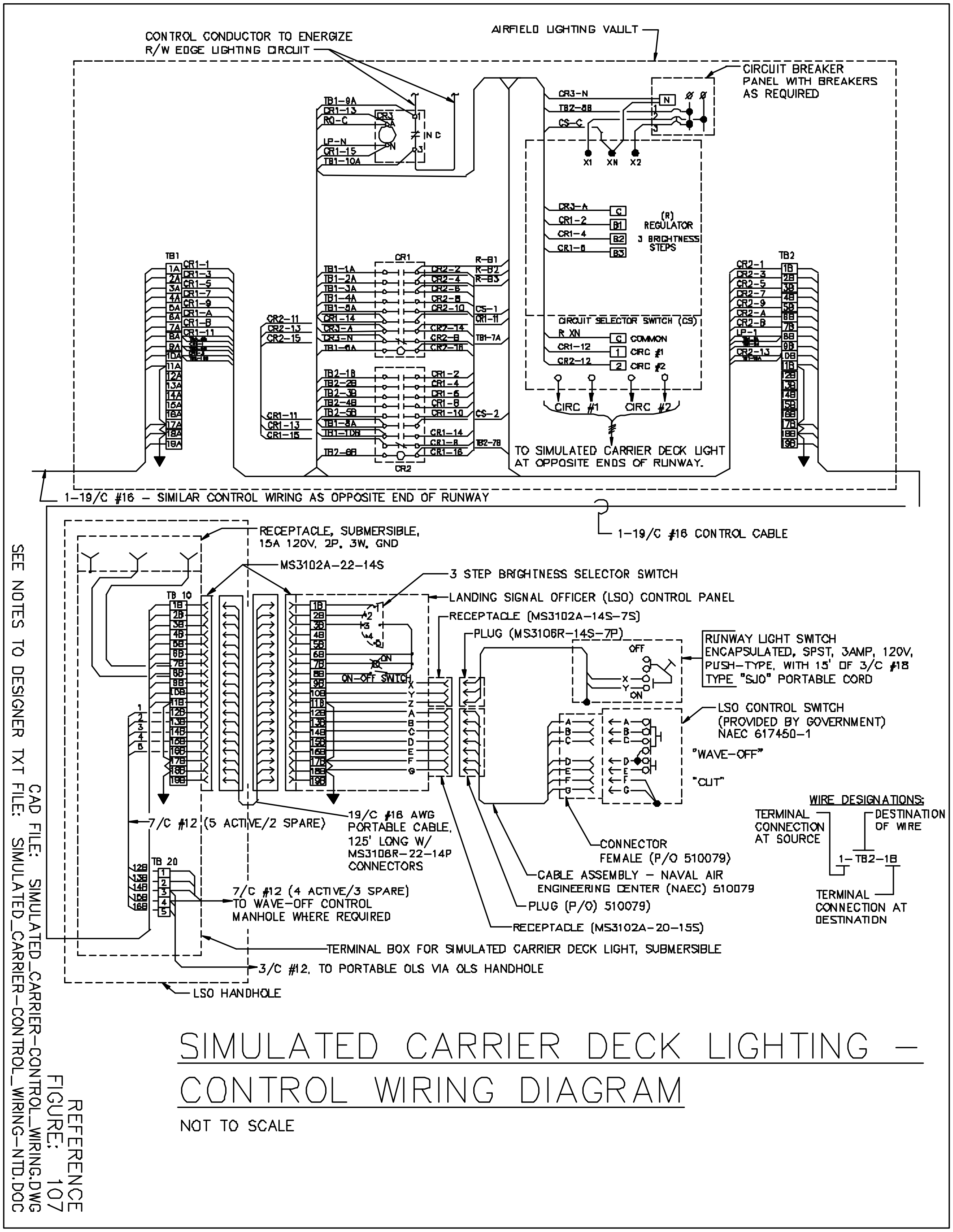


Figure 107. Simulated Carrier Deck Lighting Control Wiring Diagram

9.5. L.S.O. Control Panel and Portable Control Switch

See figure 108.

Notes to Designer:

1. The control panel connects to the terminal box in the L.S.O. handhole by a 19/c cable which mates with the above grade receptacle at the handhole. After operations have been completed, the control panel and switches are disconnected and removed.

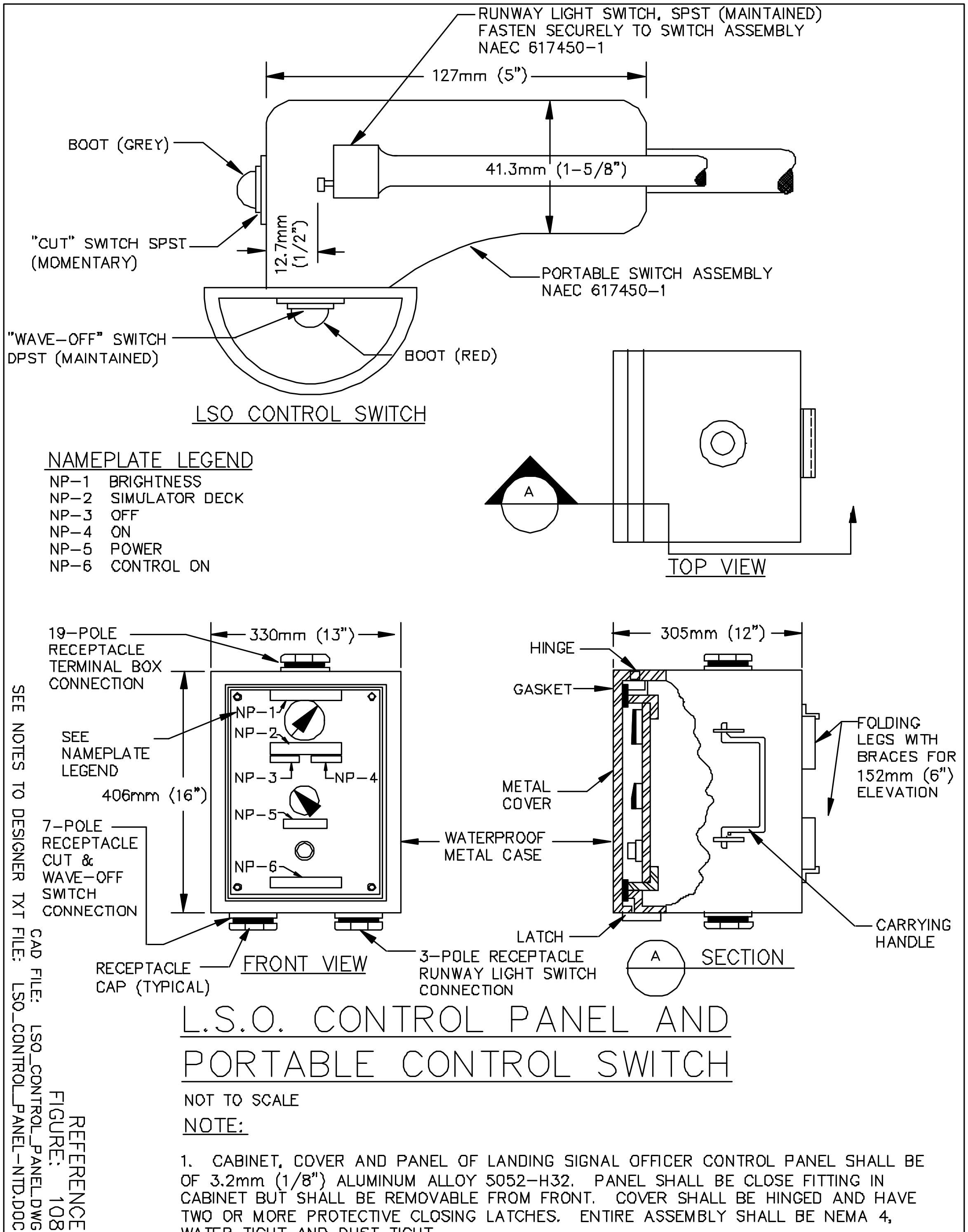


Figure 108. L.S.O. Control Panel and Portable Control Switch

9.6. Simulated Carrier Deck Light Fixture – Shallow Base and Saw Kerf Installation

See figure 109.

Notes to Designer:

1. The shallow base installation is used when a system is being installed on an existing runway. The #10 branch circuit conductors and #6 ground are connected inside the base and run to a handhole at the edge of the pavement where the isolation transformers are housed.

2. The base has anti-rotational and anti-lift fins on the bottom. The base is held in place with rigid FAA type P-606 sealant that is installed flush with the top of the base.

3. A spacer ring and flange ring with pavement ring is then installed on the base. The void between the rings and edge of pavement is then filled with a self leveling silicone sealer which allows removal of fixture and rings. The sealer is flexible and compatible with both concrete and asphalt pavements. The Navy has been using Dow Corning #890 recently with good success.

4. The purpose of the spacer ring is to allow the fixture to be lowered in case of pavement slumping around the fixture. Different thickness rings are available in 1.6mm (1/16") increments up to 51mm (2").

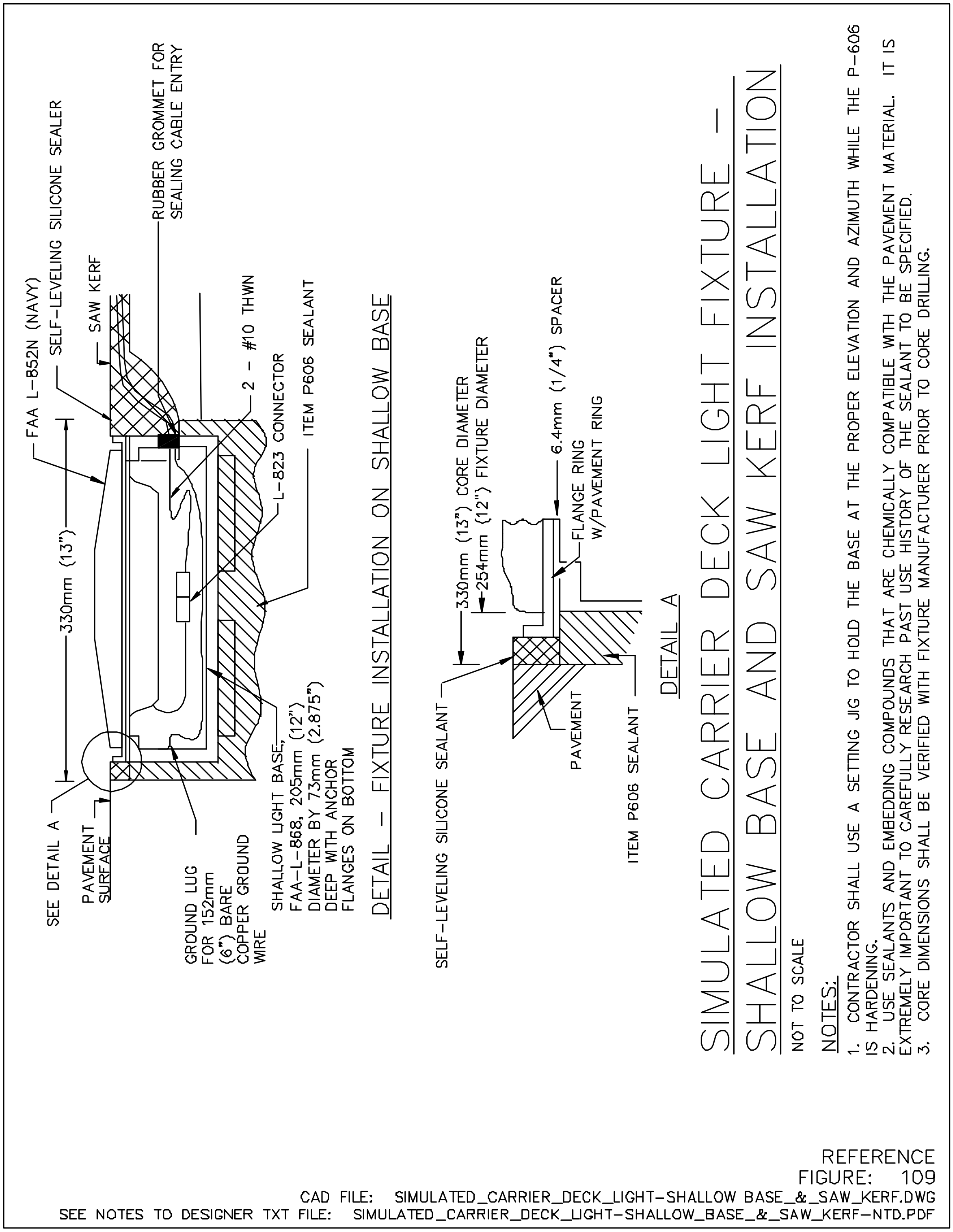


Figure 109. Simulated Carrier Deck Light Fixture – Shallow Base and Saw Kerf Installation

9.7. Simulated Carrier Deck Light Core Details

See figure 110.

Notes to Designer:

1. Actual core depth and diameter should be verified with fixture supplier.

2. Ensure saw kerfs, walls and bottom of core are clean of any loose material or debris prior to fixture and wiring installation.

3. Detail A shows a channel for installing the wiring into the fixture.

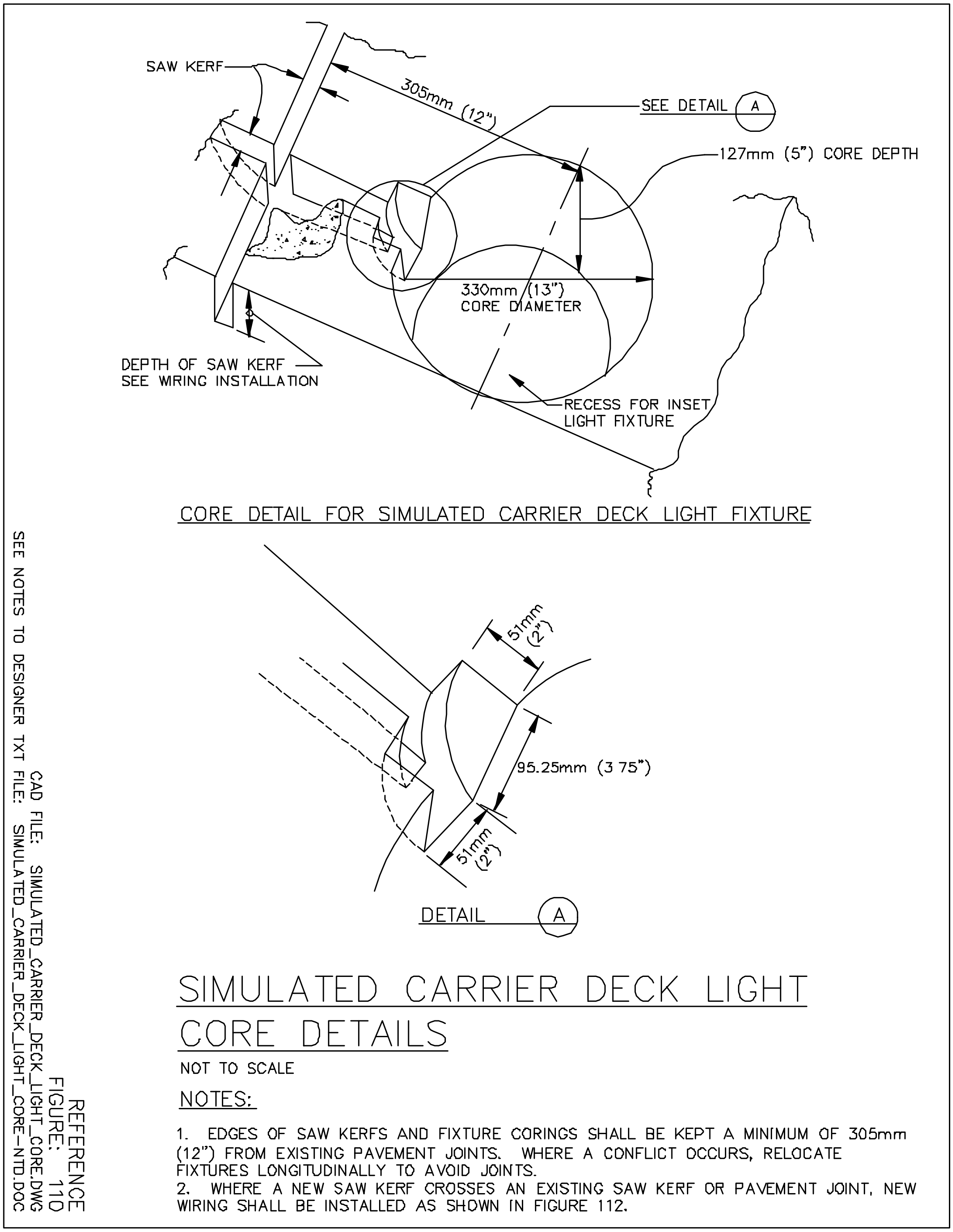


Figure 110. Simulated Carrier Deck light Core Details

9.8. Saw Kerf Wireway Details – Simulated Carrier Deck Lights

See figure 111.

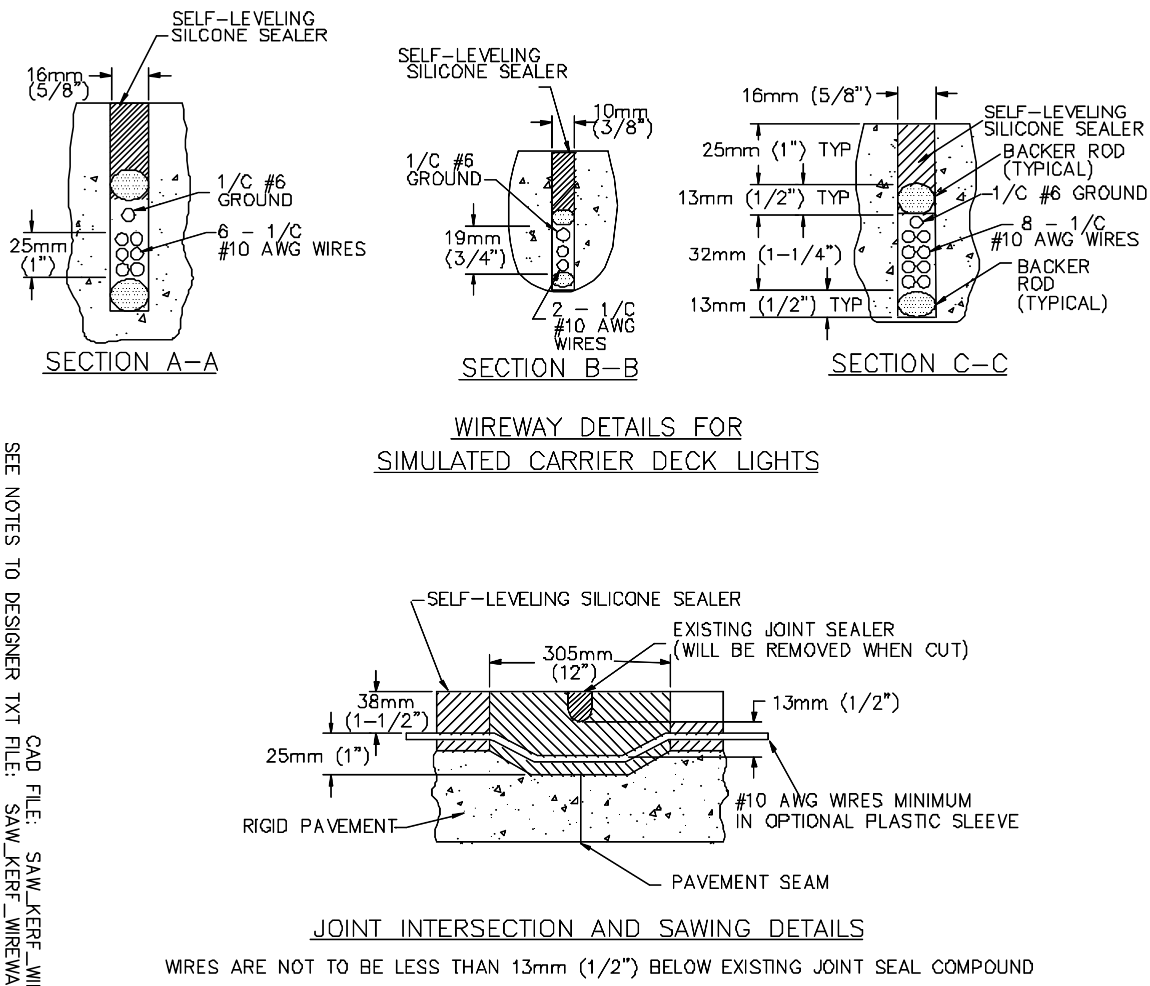
Notes to Designer:

1. The preferred method for installation of simulated carrier deck lights in new construction is to utilize a deep base at each light housing the individual isolation transformer. Each base connected by a conduit system. Installation of lights in existing pavement utilizes shallow bases for the lights. The secondary wiring from the lights are run in a saw kerf to the side of the runway and into an L-867 base which houses the isolation transformer(s) for the lights.

More recent installations have been utilizing conduit for the secondary wiring in lieu of installing the wires directly in the saw kerf. If conduit is used, a water tight seal where the conduit enters the base must be specified.

2. The backer rod in the saw kerf serves three purposes. It acts as a shock absorber, it keeps the wiring in the saw kerf, and it acts as a sealant dam so if the wiring has to be changed they aren't encased in the sealant. The backer rod should be specified to have a diameter that is 25% maximum larger than the width of the saw kerf.

3. The sealant is a self-leveling cold applied silicone sealant that is compatible with both asphalt and concrete pavements. The Navy has had good success with a product manufactured by Dow Corning (Dow Corning #890) and recommends its use in sealing saw kerfs.



SEE NOTES TO DESIGNER TXT FILE: SAW_KERF_WIREWAY-SIMULATED_CARRIER_DECK_LIGHTS-NTD.PDF
CAD FILE: SAW_KERF_WIREWAY-SIMULATED_CARRIER_DECK_LIGHTS.DWG
REFERENCE FIGURE: 111

SAW KERF WIREWAY DETAILS:
SIMULATED CARRIER DECK LIGHTS

NOT TO SCALE

NOTES:

1. DIAMETER OF BACKER ROD SHALL BE 25% MAXIMUM LARGER THAN WIDTH OF SAW KERF.
2. IN EXISTING PAVEMENT, THE EASIEST METHOD OF INSTALLING IN-PAVEMENT LIGHTING IS TO CORE A HOLE FOR THE FIXTURE AND MAKE A SAW KERF FOR THE WIREWAYS PRIMARY CABLES AND TRANSFORMERS IN THIS CASE ARE LOCATED AT THE EDGE OF THE RUNWAY.
3. TO ASSURE A SUCCESSFULL INSTALLATION, CARE MUST BE TAKEN TO SEE THAT ALL SURFACES ARE SAND BLASTED AND DRIED BEFORE THE SEALER IS APPLIED.
4. USE SEALANTS THAT ARE CHEMICALLY COMPATIBLE WITH THE PAVEMENT MATERIAL. IT IS EXTREMELY IMPORTANT TO CAREFULLY RESEARCH PAST USE HISTORY OF THE SEALANT TO BE SPECIFIED.
5. BOND #6 GND WIRE FROM EACH FIXTURE TO A SINGLE #6 GND WIRE AND INSTALL WITH CIRCUIT CONDUCTORS BACK TO HANDHOLE.

Figure 111. Saw Kerf Wireway Details – Simulated Carrier Deck Lights

9.9. OLS Pad Location

See figure 112.

Notes to Designer:

1. The FLOLS/MOVLAS (Fresnel lens optical landing system/manually operated visual landing aid system) are optical landing aids which provide pilots with a visual signal to assist in intercepting and maintaining the correct approach glide slope.

2. Optical Landing Aids (OLA) is a required visual aid for landings on aircraft carriers, but on shore based airfields the OLA is primarily an aid for training or practice. The FLOLS is a fixed signal system which automatically indicates to the pilot his position in relationship to the established glide path. Power requirements for the FLOLS is 20kVA, 120/240V, single phase, 4 wire. The waveoff lights in the FLOLS are controlled by the LSO when FCLPs are being conducted. The MOVLAS is a temporary replacement system for which the LSO (Landing Signal Officer) controls the position of the source (meatball) light. Power requirements for the MOVLAS is 3kVA, 120V, single phase, 3 wire.

3. Both systems are mobile and normally government furnished. The equipment pad is at the simulated carrier deck centerline elevation. A permanent survey marker should be installed on the pad giving correct location and alignment of the FLOLS centerline cells or MOLS mirror. A survey monument for the siting mirror is located 45.72M (150’) toward the runway threshold from the position for the face of the cells and parallel to the runway centerline. This monument or pad shall have a permanent survey marker for correct location on the siting mirror and shall be at the same elevation as the OLA equipment mounting pad.

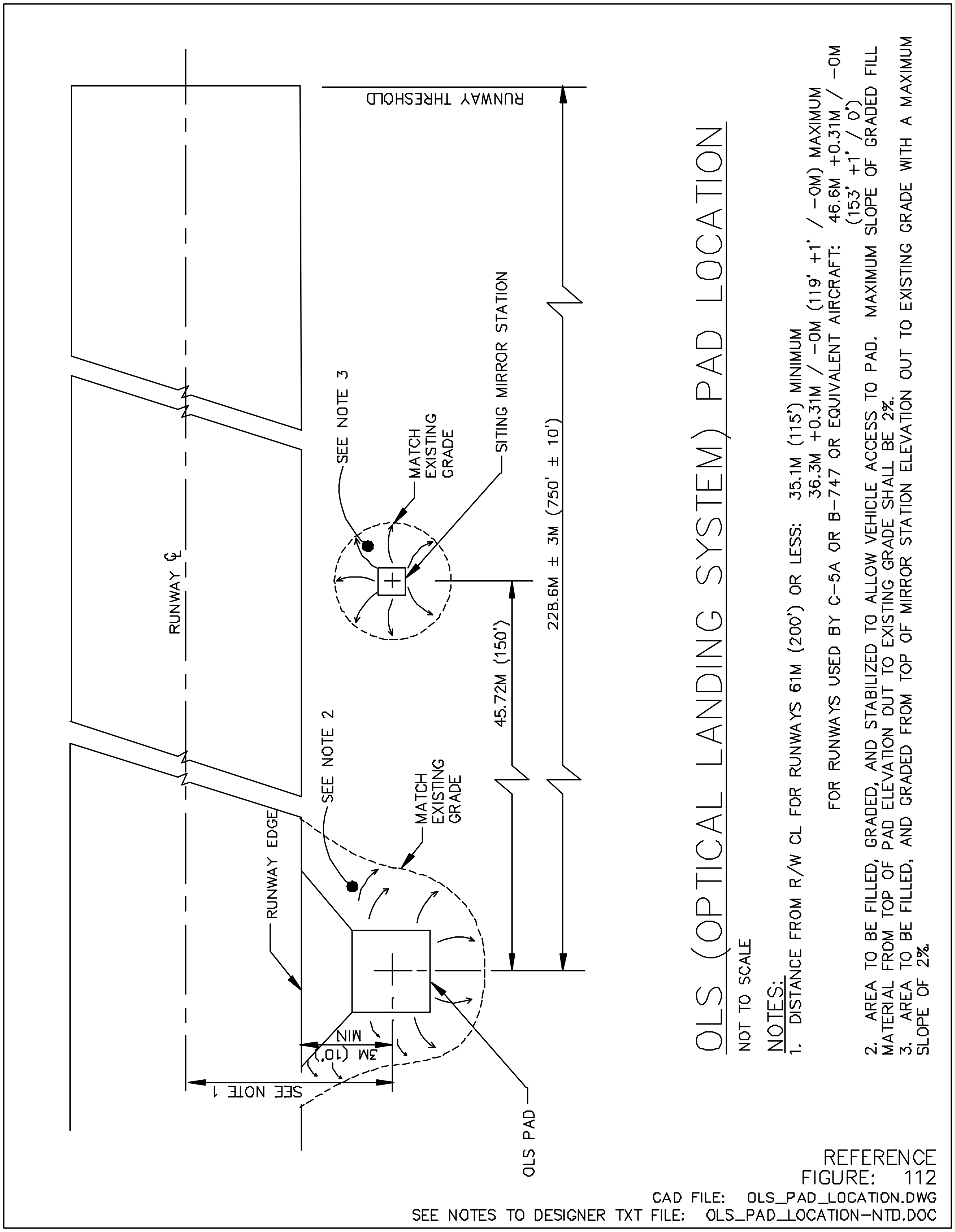


Figure 112. OLS Pad Location

9.10. OLS and Siting Mirror Pad Details

See figure 113.

Notes to Designer:

1. Top of pad elevations are required to be at the same elevation as the simulated carrier deck centerline. The requirement could put the top of the pads more than 76mm (3”) above existing grade and possible damage to aircraft could result if accidentally struck. Suggest sloping up to top of pad with graded material at a maximum slope of 2%. This would minimize damage to aircraft and allow for drainage. The material used around the OLS pad should be stabilized enough to allow vehicle access while installing and removing a FLOLS or MOVLAS trailer.

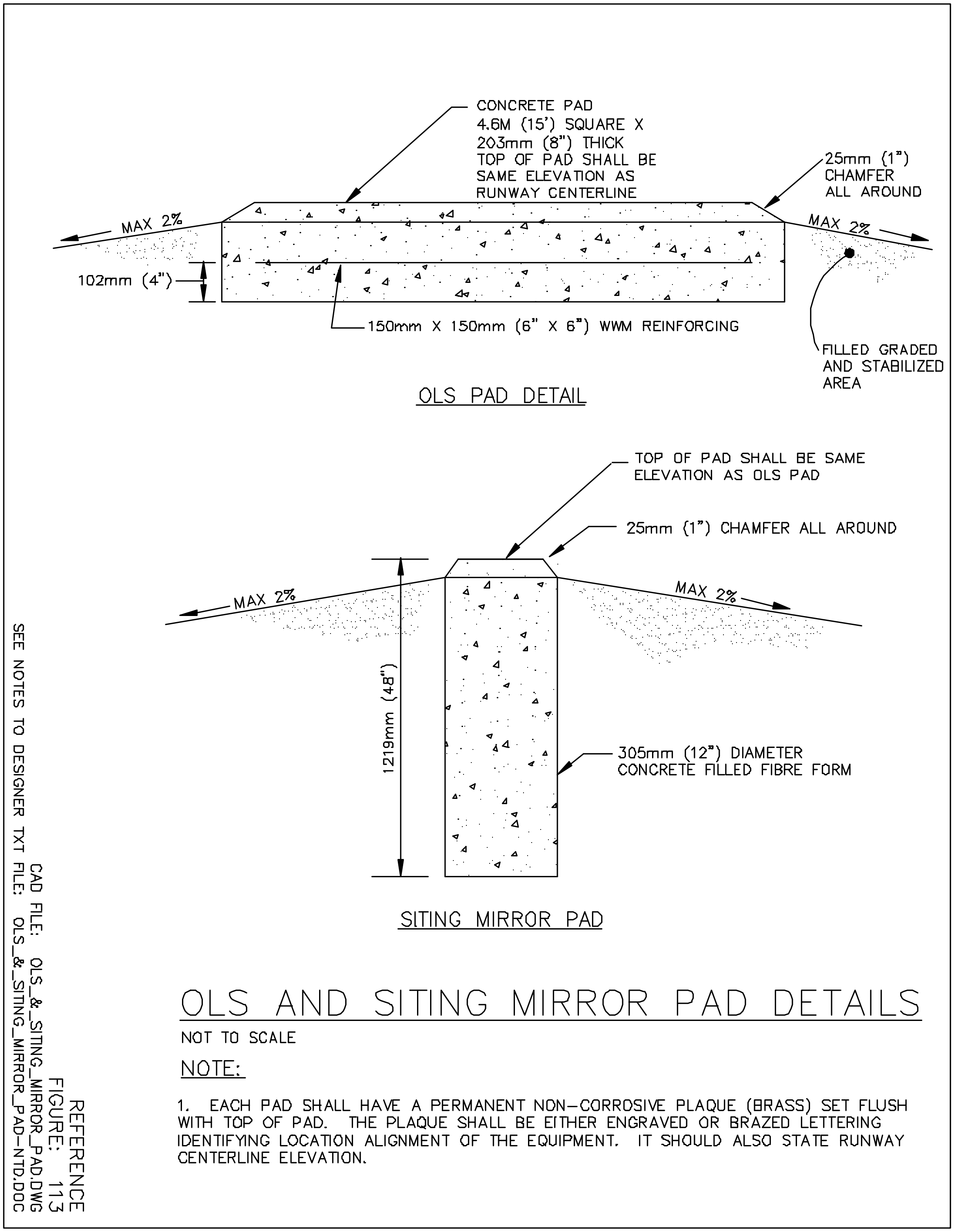


Figure 113. OLS and Siting Mirror Pad Details

Chapter 10: NAVAL FACILITIES SPECIFIC CIRCLING GUIDANCE LIGHT SYSTEMS

10.1. Circling Guidance Lighting Layout

See figure 114.

Notes to Designer:

1. The purpose of the circling guidance lights (CGL) is to enable the pilot to locate the runway from a distance and to provide visual and to provide visual guidance when flying the traffic pattern. The CGL provides visual cues for location of the runway and distance and alignment information for the downwind leg of the traffic pattern.

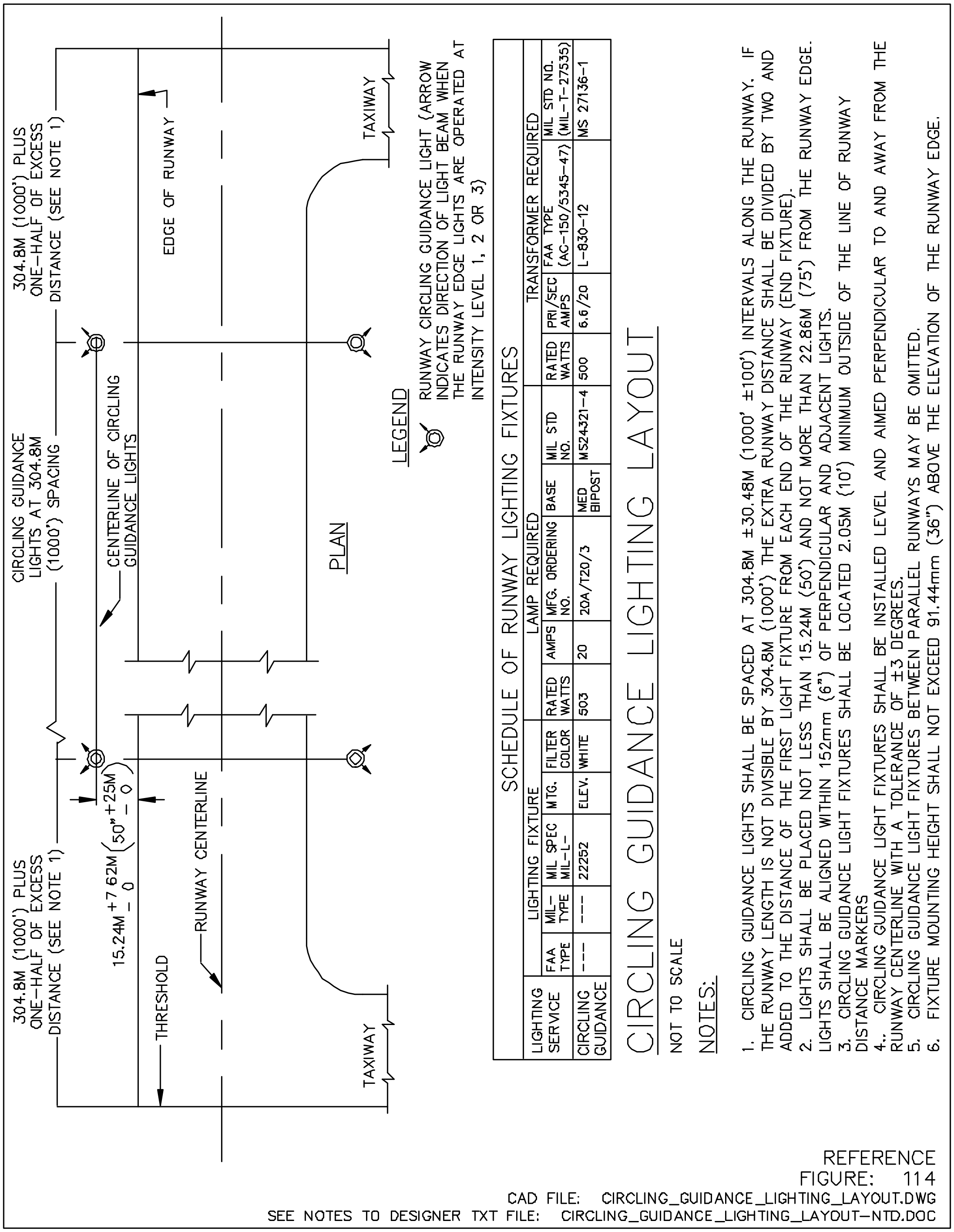


Figure 114. Circling Guidance Lighting Layout

10.2. Circling Guidance Light Fixture Installation

See figure 115.

Notes to Designer:

1. The flexible conduit allows for minor adjustments in alignment during installation and also allows flexibility of the conduit runs during freeze/thaw cycles in cold climates. The conduit shall meet the requirements of NEMA TC12 and should be at least 305mm (12") long.

2. Many contractors will purchase the L-867 bases and send them to pre-cast shops for the concrete encasement. The conduit stubs are slid through the grommets prior to casting. A minimum of 152mm (6") should be protruding from the encasement to allow the installation of the conduit couplings. The #6 equipment ground and PVC sleeve are installed prior to encasement.

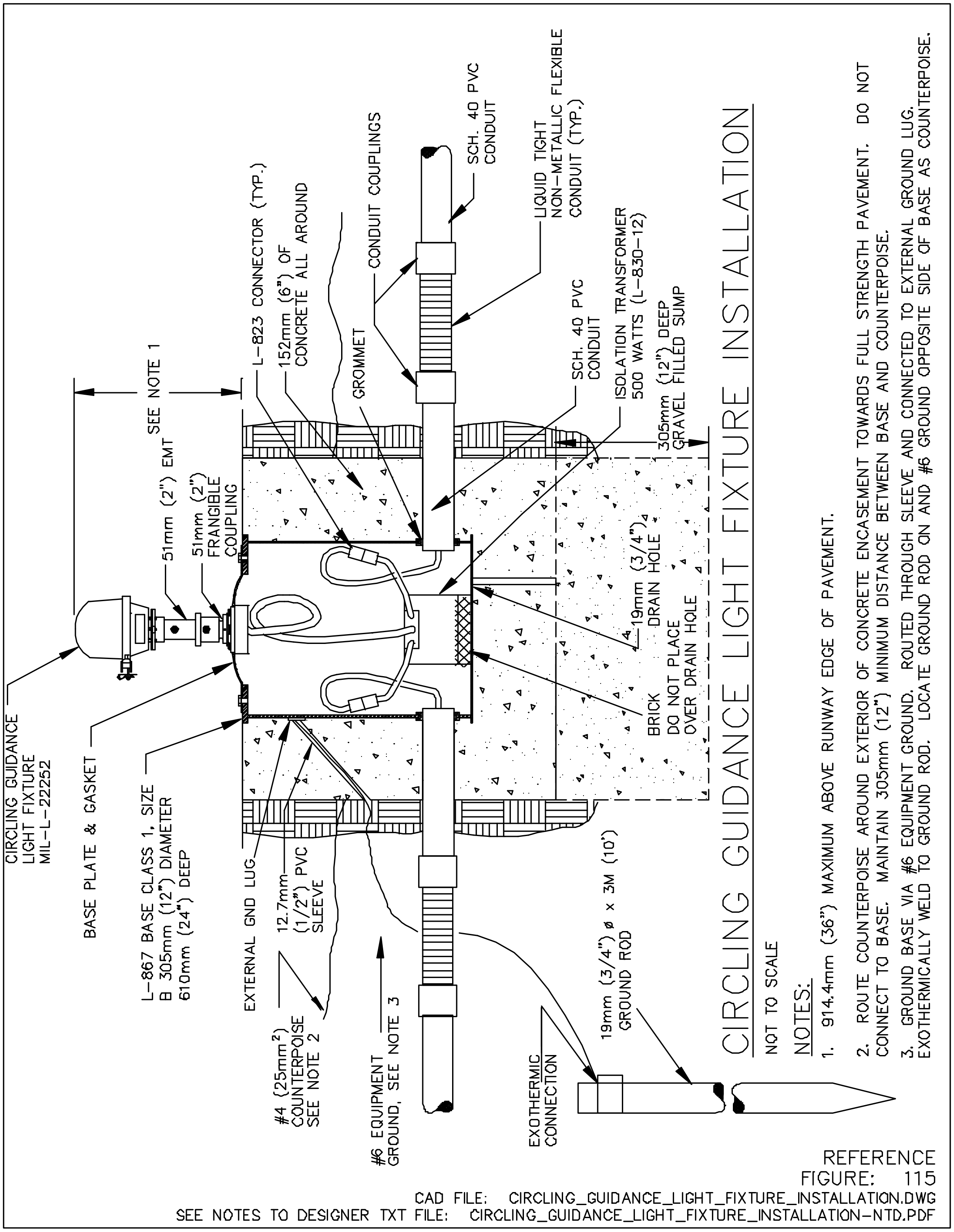


Figure 115. Circling Guidance Light Fixture Installation

10.3. Circling Guidance Control Diagram

See figure 116.

Notes to Designer:

1. NAVAIR 51-50AAA-2, WP 003 04, requires the CGL to have 3 intensity steps and the minimum intensity shall be no less than 4% of the rated intensity. An FAA type L-828, 3 step regulator has brightness levels of 10%, 30% and 100% and should be used in new installations

2. The figure shows connections to a 5 step regulator which has the following intensities:

Step	% Brightness
1	0.2
2	0.8
3	4.0
4	20.0
5	100.0

   The lowest brightness step setting on the control panel should connect to step 3 on the regulator to conform with the 4% minimum requirement.

   The figure also shows a 5 step brightness switch with only 3 brightness settings by jumpering B1, B2, and B3. New installations should use a 3 step brightness switch.

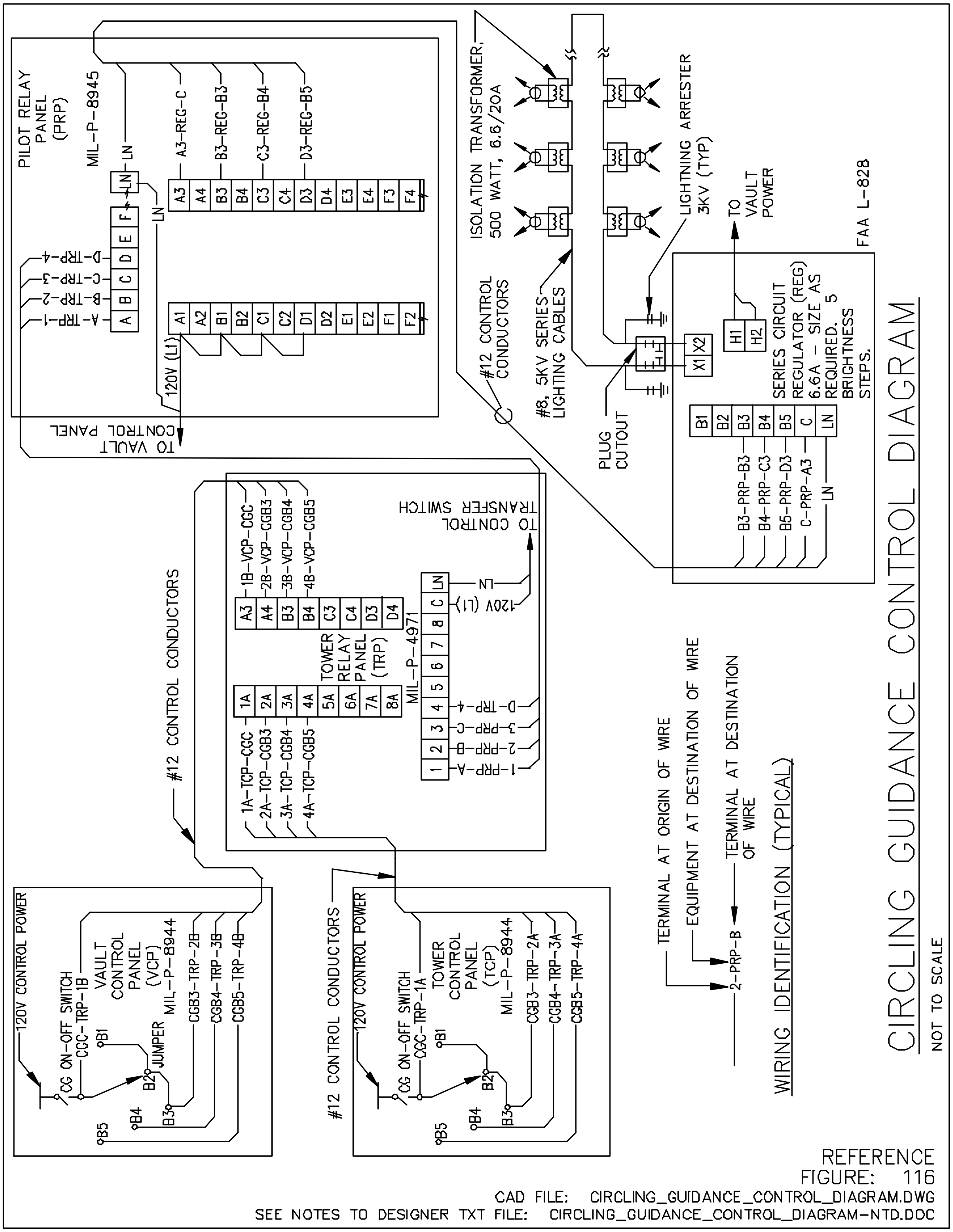
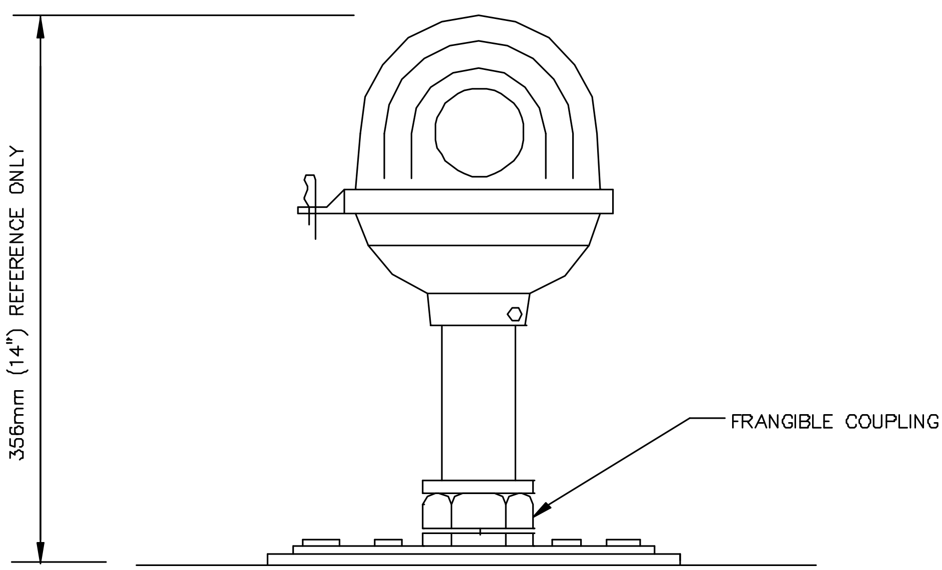


Figure 116. Circling Guidance Control Diagram

Chapter 11: ARMY FACILITIES FIXTURE DESCRIPTIONS

See figures 117 through 123.

11.1. Elevated, High-Intensity, Bidirectional Light Fixture Type L-862



APPLICATION	FILTER
RUNWAY EDGE LIGHT	CLEAR
RUNWAY THRESHOLD LIGHT	AVIATION GREEN/AVIATION RED
HELIPAD LANDING DIRECTION LIGHT	AVIATION YELLOW

ELEVATED, HIGH-INTENSITY, BIDIRECTIONAL LIGHT FIXTURE TYPE L-862

NOT TO SCALE

NOTES:

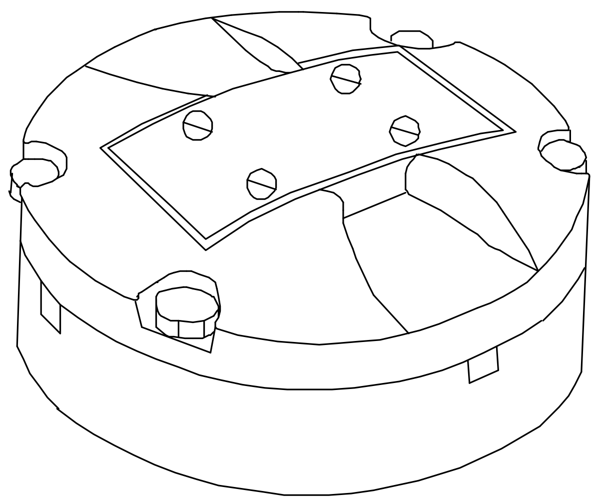
1. LIGHT: ELEVATED HIRL FAA AC 150/5345-46 TYPE L-862.
2. LAMP: 150W TO 209W 6.6A TYPE AS SPECIFIED BY MANUFACTURER.
3. TRANSFORMER: FAA AC 150/5345-47 TYPE L-830-7. IF FOR 6.6A PRIMARY CIRCUIT, 200W, 6.6/6.6A OR FAA AC 150/5345-47 TYPE L-830-6.
4. MAY BE MOUNTED ON LIGHT BASE OR CONDUIT USE FRANGIBLE COUPLING. MAXIMUM HEIGHT 356mm (14"), EXCEPT IN HEAVY SNOW AREAS MAY BE INCREASED TO 610mm (24").

CAD FILE: ELEVATED_HIGH-INTENSITY_BIDIRECTIONAL.DWG

REFERENCE FIGURE: 117

Figure 117. Elevated, High-Intensity, Bidirectional Light Fixture Type L-862

11.2. Runway Centerline, Hook-Resistant, Semiflush, Bidirectional Light Fixture Type L-852N



RUNWAY CENTERLINE, HOOK-RESISTANT, SEMIFLUSH, BIDIRECTIONAL LIGHT FIXTURE TYPE L-852N

NOT TO SCALE

NOTES:

1 THERE IS NO QUALIFYING SPECIFICATION FOR THIS AIRCRAFT TAIL-HOOK-RESISTANT LIGHT FIXTURE.

2. THE FIXTURE IS A DERIVATIVE OF THE FAA AC 150/5345-46 TYPE L-852 FIXTURE. THE L-852N IS A HIGH STRENGTH STEEL RUGGEDIZED VERSION DESIGNED SPECIFICALLY FOR US NAVY APPLICATION

4. AN EXAMPLE OF ARMY USE WOULD BE RUNWAYS FOR AN ARMY NATIONAL GUARD F-4 AIRCRAFT, WHERE TAIL HOOK IMPACT IS A PROBLEM. CROUSE-HINDS CORPORATION IS THE ONLY KNOWN MANUFACTURER OF THE L-852N FIXTURE, AND IS AVAILABLE IN TYPES V, VI, VII, AND VIII. LAMPS ARE TO BE 65 WATT OF A TYPE RECOMMENDED BY THE MANUFACTURER. WHERE MORE THAN ONE FIXTURE IS CONNECTED TO A SINGLE ISOLATION TRANSFORMER, THE FIXTURES SHALL BE ORDERED WITH BYPASS DEVICES OR RELAYS.

5. THIS FIXTURE SHALL BE USED FOR THE NAVY SIMULATED CARRIER FACILITIES WITH A BLANKING PLATE FOR THE BEAM NOT IN USE.

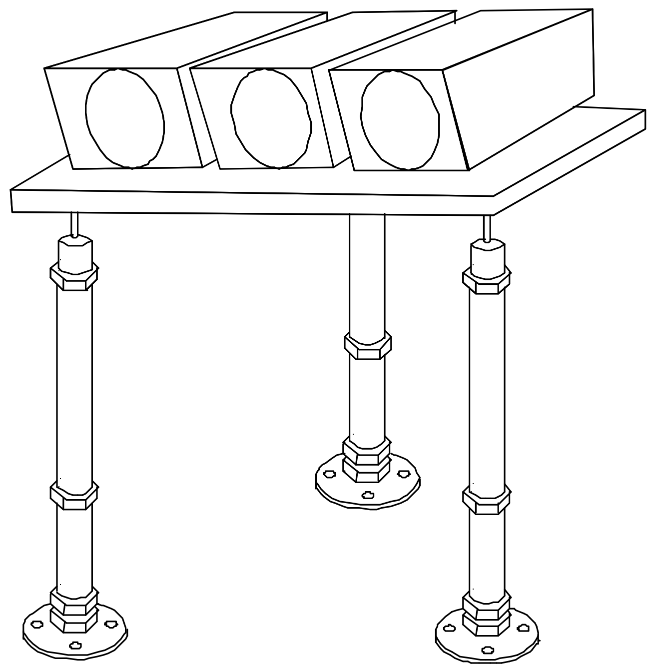
6. FILTER: AVIATION RED OR WHITE, AS REQUIRED.

CAD FILE: RUNWAY_CL_HOOK-RESISTANT_SEMIFLUSH_BIDIRECTIONAL.DWG

REFERENCE FIGURE: 118

Figure 118. Runway Centerline, Hook-Resistant, Semiflush, Bidirectional Light Fixture Type L-852N

11.3. Glide Slope Indicators – PAPI Type L-880



GLIDE SLOPE INDICATORS – PAPI
TYPE L-880, 4 Units per System

NOT TO SCALE

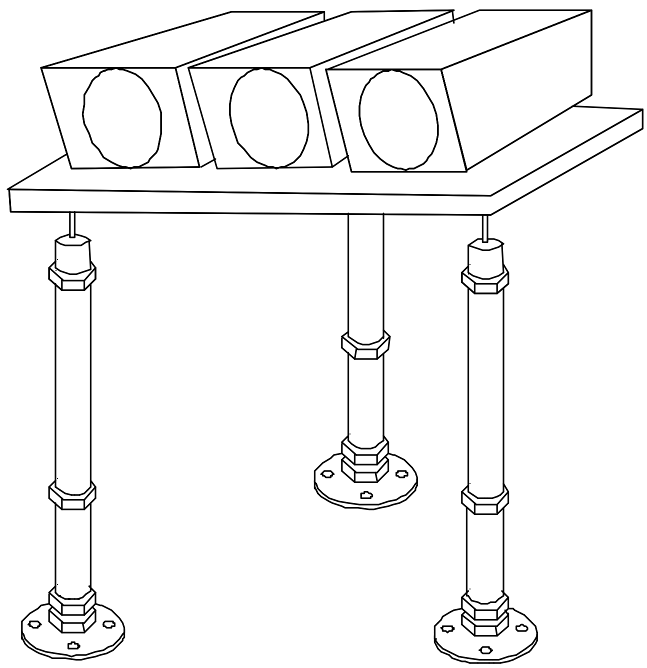
NOTES:

1. PAPI SHALL MEET THE REQUIREMENTS OF FAA AC 150/5345-28 TYPE L-880.
2 EACH LIGHT UNIT SHALL HAVE AT LEAST TWO LAMPS AND SHALL PROVIDE A BEAM OF LIGHT SPLIT HORIZONTALLY IN ORDER TO PRODUCE WHITE LIGHT IN THE TOP SECTOR AND RED LIGHT IN THE BOTTOM SECTOR.
3 A TILT SWITCH SYSTEM THAT DEENERGIZES THE SYSTEM SHALL BE PROVIDED. FAILURE OF ONE OR MORE LAMPS SHALL NOT CAUSE ANY OVER VOLTAGE OR TRANSIENTS THAT WILL RESULT IN DAMAGE TO THE REMAINING LAMPS.
4. THE LIGHT UNITS SHALL HAVE A MINIMUM OF THREE ADJUSTABLE MOUNTING LEGS FOR LEVELING.
5. THE SYSTEMS SHALL BE ON AN INDEPENDENTLY CONTROLLED CIRCUIT.

CAD FILE: GLIDE_SLOPE_INDICATOR_PAPI.DWG
REFERENCE FIGURE: 119

Figure 119. Glide Slope Indicators – PAPI Type L-880

11.4. Glide Slope Indicators – CHAPI Type L-881



THE LIGHT PATTERN AS SEEN FROM THE APPROACH ZONE SHALL BE AS FOLLOWS:

ABOVE COURSE:	◯	◯
SLIGHTLY HIGH:	◯	G
ON COURSE:	G	G
SLIGHTLY LOW:	G	R
BELOW COURSE:	R	R

KEY: ◯ WHITE G GREEN R RED

GLIDE SLOPE INDICATORS – CHAPI TYPES L-881, 2 Units per System

NOT TO SCALE

NOTES:

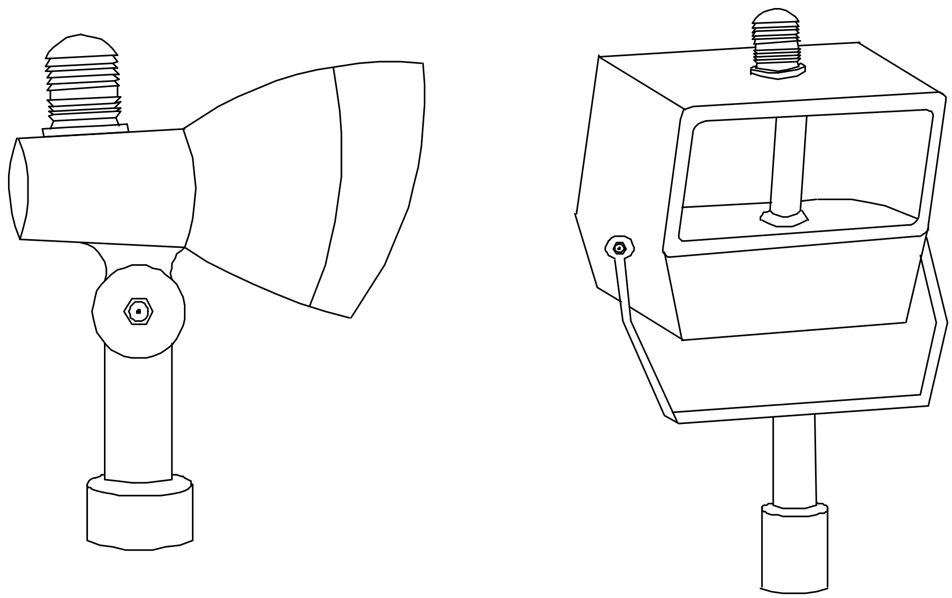
1. CHAPI SHALL MEET THE REQUIREMENTS OF FAA AC 150/5345-28 TYPE L-881, WITH THE ADDITION OF A FILTER THAT WILL PROVIDE A 2 DEGREE WIDE GREEN SECTOR IN THE CENTER OF THE WHITE OVER RED BEAM, AS SEEN FROM THE APPROACH ZONE.
2. THE CHAPI SYSTEM CONSISTS OF TWO RED/GREEN/WHITE UNITS.
3. EACH LIGHT UNIT SHALL HAVE AT LEAST TWO LAMPS AND SHALL PROVIDE A BEAM OF LIGHT SPLIT HORIZONTALLY IN ORDER TO PRODUCE WHITE LIGHT IN THE TOP SECTOR AND RED LIGHT IN THE BOTTOM SECTOR.
4. A TILT SWITCH SYSTEM THAT DEENERGIZES THE SYSTEM SHALL BE PROVIDED. FAILURE OF ONE OR MORE LAMPS SHALL NOT CAUSE ANY OVER VOLTAGE OR TRANSIENTS THAT WILL RESULT IN DAMAGE TO THE REMAINING LAMPS.
5. THE LIGHT UNITS SHALL HAVE A MINIMUM OF THREE ADJUSTABLE MOUNTING LEGS FOR LEVELING.
6. THE SYSTEMS SHALL BE ON AN INDEPENDENTLY CONTROLLED CIRCUIT.

CAD FILE: GLIDE_SLOPE_INDICATOR_CHAPI.DWG

REFERENCE FIGURE: 120

Figure 120. Glide Slope Indicators – CHAPI Type L-881

11.5. Helipad Floodlight



HELIPAD FLOODLIGHT

NOT TO SCALE

NOTES:

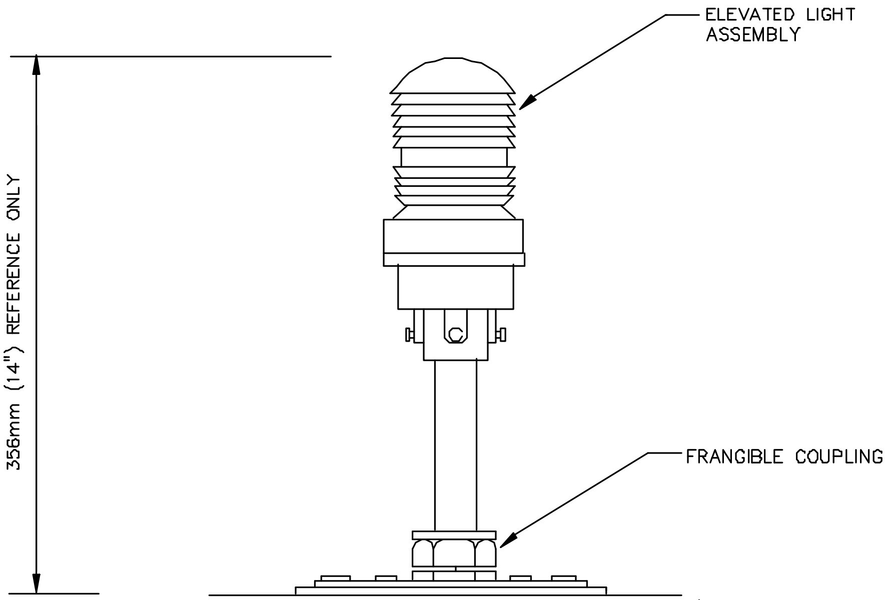
1. NO FAA STANDARD HAS BEEN ESTABLISHED FOR HELIPAD FLOODLIGHTS.
2 A SMALL OBSTRUCTION LIGHT SHALL BE MOUNTED ON OR NEAR EACH FLOODLIGHT AND SHALL BE VISIBLE FROM ANY DIRECTION. OPERATION OF THE OBSTRUCTION LIGHT SHALL BE NONDIMMING AND INDEPENDENT OF FLOODLIGHT OPERATION BECAUSE THE OBSTRUCTION STILL EXISTS WHEN THE FLOODLIGHT IS NOT ILLUMINATED.
3 FLOODLIGHTS SHALL BE MOUNTED NOT OVER 1219mm (4 FEET) ABOVE THE GRADE OF THE HELIPAD.
4. FLOODLIGHTS SHALL BE DESIGNED TO DIRECT THE ENTIRE LIGHT OUTPUT OF THE FIXTURE BELOW THE HORIZONTAL.
5. THE AVERAGE HORIZONTAL LUMINANCE SHALL BE 2 FOOTCANDLES WITH A UNIFORMITY RATION (AVERAGE TO MINIMUM) OF NOT MORE THAN 4 TO 1. THE FIXTURE MAY USE ONE OR TWO LAMPS, WITH A TOTAL WATTAGE OF NOT MORE THAN 500 WATTS, AND WILL CONFORM TO NEMA FA-1.
6 LAMPS SHALL BE AS RECOMMENDED BY THE MANUFACTURER.

CAD FILE: HELIPAD_FLOODLIGHT.DWG

REFERENCE FIGURE: 121

Figure 121. Helipad Floodlight

11.6. Elevated, Medium-Intensity, Omnidirectional Light Fixture Type L-861



APPLICATION	LAMP	FILTER
AIRFIELD RUNWAY EDGE (1), HELIPORT RUNWAY EDGE HELICOPTER STAGEFIELD LANE EDGE	BY MFR	CLEAR
AIRFIELD TAXIWAY EDGE, HELIPORT TAXIWAY EDGE	BY MFR	AVIATION BLUE
AIRFIELD RUNWAY THRESHOLD (1), HELIPORT RUNWAY THRESHOLD, ROTARY WING LANDING THRESHOLD AND LANE END	BY MFR	AVIATION GREEN/ AVIATION RED
HELIPAD APPROACH DIRECTION	BY MFR	CLEAR
HELIPAD PERIMETER	BY MFR	AVIATION YELLOW
HOSPITAL HELO WING	BY MFR	AVIATION GREEN

ELEVATED, MEDIUM-INTENSITY, OMNIDIRECTIONAL LIGHT FIXTURE, TYPE L-861

NOT TO SCALE

NOTES:

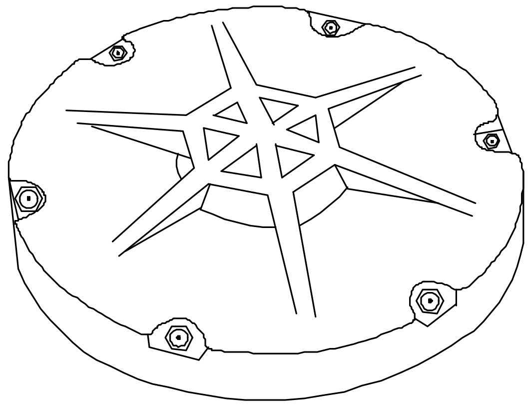
1. THE LIGHT FIXTURE SHALL MEET THE REQUIREMENTS OF FAA AC 150/5345-46 TYPE L-861.
2. AN FAA TYPE L-823 PLUG ASSEMBLY SHALL BE USED.
3. FIXTURES SHALL BE FRANGIBLY MOUNTED A MAXIMUM OF 356mm (14") ABOVE GRADE. IF SNOW ACCUMULATIONS OF 305mm (12") OR MORE WILL BE FREQUENT MOUNTING HEIGHT MAY BE INCREASED TO NOT MORE THAN 610mm (24") ABOVE GRADE
4. INTERFACE FIXTURE WITH AN FAA L-868 BASE.

REFERENCE FIGURE: 122

CAD FILE: ELEVATED_MEDIUM-INTENSITY_OMNIDIRECTIONAL.DWG

Figure 122. Elevated, Medium-Intensity, Omnidirectional Light Fixture Type L-861

11.7. Semiflush, Medium-Intensity Omnidirectional Light Fixture Type L-852E



APPLICATION	LAMP	FILTER
FIXED—WING RUNWAY EDGE, HELICOPTER STAGEFIELD LANE EDGE	45 WATT, 6.6 AMPERE	CLEAR
HELIPORT HOVERLANE	45 WATT, 6.6 AMPERE	ALTERNATING FIXTURES OF AVIATION GREEN AND AVIATION YELLOW
HELIPORT RUNWAY EDGE	45 WATT, 6.6 AMPERE	ALTERNATING FIXTURES OF AVIATION WHITE AND AVIATION BLUE
TAXIWAY EDGE, HELICOPTER TAXIWAY	45 WATT, 6.6 AMPERE	AVIATION BLUE
RUNWAY THRESHOLD, HELIPORT RUNWAY THRESHOLD, ROTARY WING LANDING THRESHOLD AND END	45 WATT, 6.6 AMPERE	180° AVIATION GREEN/180° AVIATION RED
HELIPAD APPROACH DIRECTION	115 TO 200 WATT	CLEAR
HELIPAD LANDING DIRECTION	100 TO 120 WATT	AVIATION YELLOW
HELIPAD PERIMETER	100 TO 120 WATT	AVIATION YELLOW

SEMIFLUSH, MEDIUM—INTENSITY OMNI—DIRECTIONAL LIGHT FIXTURE TYPE L—852E

NOT TO SCALE

NOTES:

1. THE LIGHT FIXTURE SHALL BE OMNIDIRECTIONAL AND MEET THE REQUIREMENTS OF AC 150/5345—46 TYPE L—852E, CLASS 2.
2. THE FIXTURE SHALL MOUNT ON A 12—INCH—DIAMETER FAA L—868 BASE.
3. THE FIXTURE SHALL BE SUPPLIED WITH A MINIMUM 16—INCH—LONG FAA L—823 CONNECTION ASSEMBLY.
4. THE FILTER SHALL BE SUPPLIED WITH FIXTURE.

CAD FILE: SEMIFLUSH_MEDIUM—INTENSITY_OMNIDIRECTIONAL.DWG

REFERENCE FIGURE: 123

Figure 123. Semiflush, Medium-Intensity Omnidirectional Light Fixture Type L-852E

KEY TO LAYERING IN AUTOCAD FIGURES

Layer Name	Description	Color	Line Type	Pen #	Line Weight
0	Standard	W	CONT	7	.35
DAYSTAMP	Autodesk layer	B	CONT	8	.18
DEFPOINTS	Standard invisible layer	-	CONT	-	-
E-DETL	Detail linework	G	CONT	3	.35
E-DETL-DIM	Dimension lines	C	CONT	4	.18
E-DETL-HID	Detail "hidden" lines	G	HIDDEN/ HIDDEN2	3	.35
E-DETL-HVY	Detail linework – heavy	R	CONT	1	.50
E-DETL-LT	Detail linework – light	M	CONT	6	.18
E-DETL-MED	Detail linework – medium	G	CONT	3	.35
E-DETL-NOTE	Numbered notes	Y	CONT	2	.35
E-DETL-NPLT	Standard invisible layer	W	CONT	7	-
E-DETL-PATT	Hatch/fill patterns	M	CONT	6	.18
E-DETL-TEXT	Miscellaneous description text	Y	CONT	2	.35
E-DETL-TTLE	Detail title	N	CONT	5	.70